AMATEUR RADIO 73

A 73 DXPEDITION ?
K4MJZ SAILS THE CARIBBEAN

the world's most complete line of advanced 2 meter fm equipment

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A true value in 2 meter FM, the Tempo fmv is the father of the Tempo VHF line. This small package offers operation at 12 volts, or with the accessory power supply, at 110 volts, for 10 watts output. An unmatched design at any price, the fmv offers high quality and top performance at a reasonable cost.
The Tempo fmv . . . $249.00

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TEMPO/fmp

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TEMPO CT HI-POWER AMPLIFIERS

Tempo also offers a full line of 2 meter FM amplifiers for mobile or base station operation. Output ranges from 45 to 100 watts for drive power of 1, 5, or 10 watts. Blends state-of-the-art technology with Tempo reliability. Tempo CT1002 10/100 VHF Amplifier $239. Tempo CT602 10/60 VHF Amplifier $190. Tempo CT252A 1/25 VHF Amplifier $99. Plus six other amplifiers for use with all current FM transceivers.

Tempo amateur two meter FM equipment is available from select dealers throughout the United States. Or you can order direct. Call or write for specifications and terms.

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73 MAGAZINE

#131 AUGUST 1971

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73 Magazine is published monthly by 73 Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year in North America and U.S. Zip Code areas overseas, $7 per year elsewhere. Two years $11 in U.S. and $12 overseas. Three years $15, and $16 overseas. Second class postage paid at Peterborough, N.H. and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A. *Entire contents copyright 1971 by 73 Inc., Peterborough, N.H. 03458. Phone: 603-924-3873. Keep your ears clean and listen for news which should be on our news pages. Send it in.*

Cover: The 73 DXpedition to the Caribbean gets under weigh. Tex will stop and operate from every rock that sticks out of the water at high tide if you ask him to. See the poll on page 55 and put your oar in the water. For that matter, Tex will be delighted to have you visit with him anywhere and take a turn or three at the rig.

Amateur Radio News Page

73 GOES TO SEA

Tex Zammit (K4MJZ), like most DXers, has dreamed of going on a DXpedition. After kicking the idea around of combining his passionate interest in yachting with ham radio, he has come close to going on a DXpedition many times. However, his plans never materialized. Finally, last New Year's Day, he bought a 41-foot sailing cutter and found himself DXpedition bound.

This might be the beginning of a typical DXpedition if Tex had not been urged to talk with Wayne Green (W2NSD), publisher of 73 Magazine and a veteran of DXpeditions to KS4, JY, 9N1, YA, FO8, and 5W1. Together, the two men planned the first mail-order DXpedition. Rather than picking a rare spot and operating, Tex is asking 73's DXer readers to pick out the islands, countries, bands, and modes to be heard on a lengthy sail through the entire Caribbean area. Islands visited will be those most needed by the most people. Hams vacationing during the DXpedition can sail aboard the ship, the *Reverie*, as a crew member (while paying their own way). In addition, 73 Magazine will be handling all the QSLs for the DXpedition along with issuing a series of awards for working Tex in the various island groups.

Immediate plans call for some cruising around the Bahamas from mid-August until mid-September. At this time Ken Raupach (WA4CYX) will be aboard for some sailing and operating. K4MJZ/VP7 will be the call used throughout the Bahamas and VP2VAH the call issued for British Virgin Island operation.

The *Reverie*, possessor of a ten year history of racing triumphs, is easily spotted by the ham-yachtsman. Generally run sloop rigged, she is a 41 foot Owens cutter with a deep blue bottom, white water line, and light blue topside. She will generally be flying the signal flags "73" when entering and leaving U.S. ports.

Not until September will the *Reverie* begin her DXpedition in earnest. It is hoped that there will be time for all those interested in this unique DXpedition to send in the coupon (page 55) with the islands that they would most want to work, the mode they would prefer to use, and the bands. Equipment is posing a problem, but with luck, even 80 and 160 meter operation is contemplated. As results come in, an itinerary will be made up with dates, locations, possible operating frequencies, and calls to be used. It will appear in 73 Magazine along with details on the awards program.

The *Reverie* has been overhauled and extensive sea trials have been

FCC ACTS: VHF HOME CONSTRUCTION TO BE STOPPED?

The FCC has recently been cracking down on an old and ignored rule which could have profound effects upon amateur radio. In Part 15 of the FCC regulations there is a rule which states that receivers for use above 30 MHz must be certified as being within the regulations on spurious emissions.

The intent of the rule seems to have been to put the responsibility for receiver emissions of television sets, CB receivers, etc., upon the manufacturer rather than on the consumer. This is not unreasonable since few users would know what to do about interference their receivers might be causing. Manufacturers of commercial VHF equipment for sale to the general public have been meeting the requirements of Part 15 and have been having their receivers certified. This is not a simple procedure, but one which requires the use of extremely expensive laboratory equipment such an panoramic receivers, etc.

The application of this old rule to equipment for sale to radio amateurs is new and has manufacturers in a big stew. Some factories have had to hold up the shipment of two meter FM equipment for over two months while submitting their receivers for the nec-

FLIGHT TEST:

of awards for working Tex in the various island groups.

made up with dates, locations, possible operating frequencies, and calls to

up the shipment of two meter FM equipment for over two months while

FLIGHT TEST:

AMSAT AIRCRAFT I

OSCAR & SYNCART PLANS ADVANCED

The weekend of May 15th and 16th marked a major event in the short history of the Radio Amateur Satellite Corp. (AMSAT). Honoring International Telecommunications Day (May 17), which commemorates the founding in 1865 of the International Telecommunications Union, a breadboard model of a 2 to 10 meter repeater was flown aboard a light aircraft over a route which included most of the northeastern part of the U.S.

The repeater received signals between about 145.9 and 146.0 MHz and converted them to 29.45 – 29.55 MHz. A beacon signal on 19.45 mHz enabled acquisition of the aircraft even when no signals were coming through. Liaison for the AA-1 flight was provided by a net operating on 7225 KHz with WA1IOX at the Talcott Mountain Science Center, Avon, Conn., as net control.

The plane left Friendship airport about 9 AM EDST on Saturday, May 15, heading northeast toward Boston. It passed over Manchester, N.H. and turned westward toward Rochester, N.Y. From there the route was over Canada to Pontiac, Michigan. Sunday morning they headed aross lower Michigan to South Bend, Ind. and then south over Kokomo, Ind.; turned east to Columbus, Ohio, and back to Friendship.

The AMSAT aviators were pilot Jim Cristo (no call), Joe (Skip) Raymond, WA4EAG, Co-pilot; and Jan King, W3GEY, in charge of the repeater equipment.

Literally hundreds of stations participated in the test, as witnessed by the list made aboard the plane by W3GEY. The contributions of W8FSO in the communications network was particularly noteworthy as he was in contact with the plane during a good portion of its trip west across Canada as well as itsts flight east across Ohio and West Virginia.

Others flights are planned for the months to come before the A-O-B satellite is launched. Some may involve the 2 to 10 meter repeaters used on this flight, but others may take aloft a 432 MHz or 146 MHz repeater being constructed by DJ4ZC in Germany or a 4-channel FM repeater being constructed in Australia.

OSCAR & SYNCART

AMSAT is currently engaged in two major efforts, the AMSAT-OSCAR-B (A-O-B) and SYNCART (Synchronous Amateur Radio Transponder) amateur satellite projects. Approval to launch A-O-B was received from NASA on February 23, and it is hoped that SYNCART will be approved by NASA later this year.

SYNCART, proposed to NASA as an experiment for the ATS-G Applications Technology Satellite, represents an opportunity to achieve a high-power, long lifetime amateur communications relay on a synchronous satellite to be placed into earth stationary orbit around 1975. ATS-G is planned to contain a thirty-foot parabolic reflector capable of providing high-gain earth coverage in the VHF amateur bands. AMSAT has proposed to provide as part of this satellite, on a non-funded basis, a 20 watt PEP linear repeater capable of handling 20 to 50 amateur transmissions simultaneously using a frequency of approximately 145.9 MHz for the amateur-to-satellite link, and approximately 432.2 MHz for the satellite-to-amateur station downlink.

SYNCART'S projected lifetime of several years will effectively open 200 KHz segments of the two meter and seventy centimeter amateur bands for long-distance use by amateurs in North, Central and South America on a full-time basis.

AMSAT-OSCAR-B (A-O-B). AMSAT's primary efforts are concentrated toward the development of a series of long-lifetime operational satellites that can be used for everyday amateur communications. AMSAT-OSCAR-B, the first satellite of this series now under construction, will bring satellite communications to a broader base of amateurs for such activities as contests, DX and traffic handling. In addition, a series of aircraft flight tests with the AMSAT-OSCAR-B satellite repeater is planned to provide training and stimulate interest in preparing for amateur satellite communications. a launch early next year. Three repeaters are under development for this series of satellites, one in Australia, one in Germany, and the third in the United States.

Courtesy of **AUTO-CALL** *June 1971*

The *Reverie* has been overhauled and extensive sea trials have been completed – including experimentation with kite borne antennas. Stores have been brought aboard and by the time you read this, the *Reverie*, and guest operator Rick Rice (WA4YNN), will be sailing towards West Palm Beach, Florida. This will be the U.S. port of departure and final

On board *Reverie*. Tex K4MJZ is seated in the cockpit.

JOHN GORE SCHOLARSHIP

The John Gore Memorial Scholarship is awarded each year to a licensed radio amateur who is studying for a career in electronics or related science. The scholarship for the academic year 1971-1972 pays $500. Information may be obtained by writing the Scholarship Committee Chairman, Henry DeCourt, W3WZN, 8101 Hampden Lane, Bethesda, MD 20014.

LICENSE EXPIRATION NOTICE SERVICE

Don't let your license expire because you forgot the renewal date! Send a self-addressed, stamped, postcard to the License Expiration Notice Service. At the top left edge write the date (month and year only) when you want the card to be mailed back to you. Write anything you want to say to yourself on the card. The card will be mailed on the date indicated.

This is a volunteer service and the Foundation cannot accept any responsibility for its operation. However, it has been working efficiently for 8 years. If for any reason the service should be discontinued, your card will be returned to you. Send your card to: **Licenae Expiration Notice Service, Joan Machinchick, K3KBI, 1023 Lake Claire Drive, RFD 4, Annapolis MD 21401.**

submitting their receivers for the necessary certification and okay by the FCC. Needless to say this has cost this already hard hit industry hundreds of thousands of dollars in income.

A well known legal firm which deals primarily with the FCC has examined the Part 15 regulations and opined that once the FCC has decided that manufactured ham equipment comes under this regulation, there is no way short of a change in the regulations for them to avoid including all home-built amateur receivers for use above 30 MHz in the same interpretation. Of course it is not all unknown for the FCC to come up with some fascinating interpretations of their own regulations and, if they want, to just turn their collective heads and ignore flagrant violations. Hopefully this is what the powers that be at the FCC have in mind for amateur builders of VHF gear. Certification, while possible in principle, would seem in practice to be beyond all but the most affluent amateur and the application of Part 15 to homemade receivers would probably end home construction once and for all.

Hurry, then, to send in the coupon on page 111 with a list of the islands you need the most – in the order that you need them, and the bands and modes on which you would like to work them. Send it to DX Editor, 73 Magazine, Peterborough NH 03458.

EDITORIAL BY WAYNE GREEN

SEXY COVER PICTURES

Time was when a partially clad chick on the front cover (or anywhere in the magazine, for that matter) would bring in a raft of bitter complaints from Scoutmasters, clergy, and assorted party poopers. Apparently those days are definitely gone by – or perhaps they are busy writing to Playboy and the X movie crowd. At any rate, our recent covers have brought naught but huzzahs.

A sexy photograph in the mail every now and then brightens up an editor's mail, making his day a bit more complete. So be it known that I am still keeping an eye peeled for cheesecake, amateur radio style. If the young lady has a ham ticket so much the better – or perhaps she is the XYL or YL – no matter as long as she looks gorgeous and has some ham gear or an antenna in the picture somewhere.

For example, here is a shot of my wife Lin, complete with memories of the February cover shot of her on skis. This wasn't quite hammy enough to make the cover, but it seemed a shame to just pass it up entirely.

Eddy W5ZBC sent in this picture of Dianna Risinstein, Miss Louisiana Un-

include both of those frequencies in the RACES allocation, thus enabling the Radio Amateur Civil Emergency Service groups to utilize existing repeater installations. AFter all, RACES doesn't take an awful lot of time each week, and the "public service" aspects of this application of the repeaters might be just one extra feather in our collective hats.

The "standard" separation between repeater inputs and outputs is 600 kHz, as you probably know by this time. Look at those RACES allocations and you'll see that no such spacing is possible with that frequency grouping.

Are the RACES folk just going to make do without repeaters and struggle along with their nice old Goonie Boxes, or are they going to try and aim more at the state of the art by shifting to FM and repeaters? Repeaters are the obvious answer to emergency operation, of course. A repeater enables all of the mobiles, base stations and even hand units to talk with each other over a very wide area, extending even little one watt pocket units so they can reach out perhaps 50 miles.

Perhaps things are not as snafu as they appear on the surface, though my contacts with government agencies gives me little reason to have any honest hope about this. I will welcome letters from interested or involved readers on the subject.

Technicians Above 147 MHz?

There is not, at this writing, despite what you may have read in the June

promising, events rise up and force a delay.

A couple of months ago I asked if anyone was interested in going to Europe this year. Sure enough, many of the amateurs and their wives who went with us in 1963 sent in their reservations immediately. Then, just as things looked bright, came the change in editors and I found myself tied again to that inexorable monthly deadline . . . a deadline that will not permit any three-week absences, even for things as valuable and fun as Europe. Well . . . maybe next year?

Spectronics

Art Housholder (Spectronics, Ill.) called to ask that I clarify the implication in the K6MVH editorial in June that he was directly involved with the new R.P.T. Magazine. Art explained that his interest is simply that of an avid fan and that neither he nor anyone else directly connected with Spectronics, Inc. has any financial interst in R.P.T.

Ads = Pages

This issue of 73 is a lot thinner than I like. With a little help from you I could easily make each issue run from 144 to 160 pages. The hard economic facts are simple: we can publish about four pages of magazine for every page of ads. A 144-page magazine must have about 36 pages of ads to break even. With a bit of help from you I think we could get the 36 to 40 pages of ads that we need to bring you a big fat magazine every month.

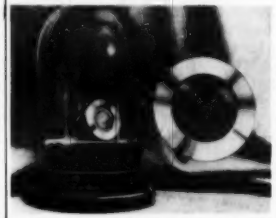
If you like the idea of having ten to twenty more interesting articles in 73 every month, perhaps you will give me a hand in convincing the advertisers that it is important to them to support 73. What can you do to help?

1. Send in the reply coupon on page 112 (or a copy . . . or just a list of the companies you want to send you info). Send in one for friends, fellows you work on the air who want info, etc.

2. The advertisers in 73 are making it possible for you to enjoy the

QST, any regulation prohibiting Techs from using repeaters with output

magazine at about 25% the actual cost of the magazine. Why not reward



The desk clock shown in the photograph does have one thing in common with a sundial . . . there are no moving parts. This unique time piece was built by the Motorola Semiconductor Products Division Central Research Laboratories, at a developmental cost of about $25,000 and displayed at the Electro-Optical Systems Design Convention in Anaheim, California to demonstrate what can be done with semiconductors and what could happen with the clocks and watches of the future.

This clock represents three departures from the conventional design. First, there are no moving hands; instead, there are 72 light-emitting diodes arranged in two circles. The outside circle is made up of 60 diodes and marks the seconds and minutes. Each second or minute is marked by an apparently moving red light as the circuit switches power to the appropriate diodes in sequential fashion. The inside circle of 12 diodes marks the hours in the same fashion. With this arrangement, only 3 diodes are turned on at any one time. This is an important design aspect because the diodes draw current which, in the case of portable clocks, must be supplied by a small battery. With this newly developed system, it is expected that 2 small batteries can drive the clock for about one year before needing replacement.

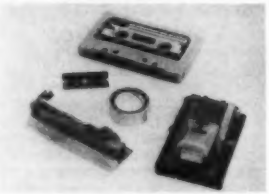
The second departure is that the

NEW PRODUCTS

CASSETTE TAPE SPLICERS

Two new cassette tape splicers have been introduced by GC Electronics as part of its Audiotex product line. The manual model – 30-652 "Eze-Splice" – is priced at $2.95 and consists of a splicing block with felt-tipped tape hold-down clamps.

The second model in the line, 30-650, is priced at $4.95. It has two blade positions, one for cutting while the other provides a tapered trimmed splice. The new splicers are among the first on the market specifically designed for the hard-to-handle 1/8-inch wide cassette tape.



Both devices are suitable for editing and for repairing broken cassette tape. The 30-652 is supplied with a separate cutting blade. The 30-650 is semi-automatic and has a built-in blade for making the diagonal cut and an integral pair of cutting blades for after-splice trimming. Two felt-tipped tape hold-down "fingers" provide an important "third hand" needed when splicing tape. *GC Electronics Division of Hydrometals, Inc., 400 South Wyman Street, Rockford IL 61101.*

PERSONAL PORTABLE VHF FM TWO-WAY RADIO

Aerotron, Inc. has announced the first of a series of "Shirt Pocket Size" hand-held, two-way radio equipment. The new Aerotron "600" series are compact, durable and easily serviced. The unit features 1W audio section and is available in the frequency range

shame to just pass it up entirely.

Eddy W5ZBC sent in this picture of Dianna Risinstein, Miss Louisiana Un-

iverse, climbing his tower. This is the kind of photograph that might make it for the cover. Keep in mind, if you are shooting for our cover, that the picture must be a vertical one – that room should be left for the title of the magazine on the left side – and that it should be made with a minimum of a 2¼" negative. 35mm doesn't make it for this type of work. Black and white only, by the way. We'll have to have a lot more advertisers before we go back to spending the equivalent of a 16-page section of the magazine for a full color cover photograph.

RACES

It is interesting – almost fascinating – to note that the RACES allocations on two meters run from 145.20–145.68 and 146.82–147.33 MHz, thus making it totally impossible for the RACES nets to use the existing FM repeaters and crystal combinations.

Since there are only a few areas of the country where repeaters are not functioning on 146.34/94, it would seem almost excessively logical to

Technicians Above 147 MHz!

There is not, at this writing, despite what you may have read in the June QST, any regulation prohibiting Techs from using repeaters with output above 147.000 MHz. There eventually may be, since there is a question with respect to the legality of the Tech "operating" the repeater transmitter in a band he is not licensed to use. Perhaps it will be necessary to resort to sophistry to continue the concept that the repeater owner is actually "operating" his repeater, while the user is just using it and not actually in control. True, the carrier of the user does turn on the repeater transmitter, but is this really the same as the user "operating" the repeater?

I, for one, would like to see the regulations interpreted in their broadest sense so that all repeater transmitters could operate within the bands allocated to the repeater owner or trustee. This would help to open up repeater operation onto the lower bands, a trend that I hope will come. How great it would be if a tone actuated relay could put a repeater onto a 75 meter channel or a 20 meter channel! A repeater trustee with an Extra Class license would enable the repeater to use the choicest parts of these low bands in that case.

Once the FCC goes out from under the backlog of comments on recent dockets they plan to get to work on the repeater rules. Hopefully we will see something on this by fall.

Comments on Phone Band Expansion

When we remember the furor created by the original "incentive licensing" proposals, the latest phone band expansion proposals was hardly noticed. The latest count, with the deadline for comments two weeks past, was about 100. Is this a massive agreement with the band expansion or massive apathy? It certainly is massive something.

European Trip

Remembering the fun that we had on the last 73 Tour of Europe, I've tried, now and then, to organize another. Each time, just as things look

2. The advertisers in 73 are making it possible for you to enjoy the magazine at about 25% the actual cost of the magazine. Why not reward them by giving their products very serious consideration when buying. All other things being about equal, who not give the nod to a 73 advertiser at buy time?

3. If you write to advertisers make it a point to mention that you have been reading their ads in 73. If they haven't been advertising you might mention that you haven't seen their ads because you read only 73. Well, you don't have to actually lie, but you could exaggerate a little?

When you visit a distributor let him know that you read 73 and are anxious to have him support 73 and for him to encourage manufacturers to support 73.

If manufacturers realized how seriously they were cutting into their sales by not advertising in 73, they would all be with us every month. But they are confused by wild circulation claims of other publishers, sworn to on a stack of bibles of all faiths. They are impressed by old age, reactionary policies, non-controversial editorials and cut rate ads (which mean that *you* get fewer pages of articles).

Ads in 73 *do* sell. We carefully thread them through the magazine to make sure that every reader *sees* every ad. Whether they are read or not is up to the advertiser and his ingenuity. We can't *make* the products sell, of course, all we can do is make sure that the ads are seen.

If only ten of the advertisers running full page ads in one or more of the other ham magazines were to include 73 in their regular advertising schedule you would have a big fat magazine to read every month. Just ten of the following full page advertisers could swing the difference if they were regularly in 73: Eimac, Spectronics, Harrison, Robot, Trigger, Hy-Gain, Galaxy, Ten-Tec, World Radio, Ehrhorn, Allied-Radio Shack, Gotham, Hallicrafters, Collins, Amateur Electronic Supply, RCA, Savoy, Rohn, Sams, Electro-Voice, Heath, Newtronics, Kirk, Ham Buerger, Arrow, Amrad, Avanti, Hal, Barry, R&R. It wouldn't take very many of those multi-page ad spreads by Swan, Hy-Gain, Heath, Spectronics, etc., for us to be able to give you more articles than you could read.

. . . Wayne

Tell our advertisers your saw it in 73

for about one year before needing replacement.

The second departure is that the mechanical movement has been replaced by tiny integrated circuits. These circuits provide the signals that turn on the appropriate diodes to indicate hours, minutes, and seconds.

The third departure is that the timing device is a quartz crystal instead of a tuning fork or a circular balance staff. A quartz crystal is one of the most accurate frequency generating devices known to technology and is expected to give this time piece unsurpassed accuracy.

The light-emitting diodes are small pieces of special solid material (gallium arsenide phosphide) that glow bright red when a voltage is applied to them. They contain no filament or gas as do more conventional light sources, but actually convert a direct current (dc) into red light.

Although currently only in the research phase, it is almost certain that the electronics inside will be commercially adopted not only in clocks but wrist watches as well. It is expected that a full integrated form of the clock circuit will exist within the year for application in clocks. Further work is being done to increase the efficiency of the light-emitting diodes so that the small battery of a wrist watch will be able to operate it.

The unit features 1W audio section and is available in the frequency range of 146 to 174 MHz. Test jacks make possible all important measurements: RF power output, deviation, frequency, receiver sensitivity, audio output and distortion . . . without the need to open the case. The "600" series features "crystal lattice filtering." The transmitter section is available in power output levels of 100 mW, 1.8W and 50W. Options include continuous tone squelch and up to 6 channels capability. *AEROTRON, INC., P.O. Box 6527, Raleigh NC 17608.*

SOLID ELECTROLYTE ALUMINUM FOIL CAPACITORS

Amperex Electronic Corporation, a subsidiary of North American Philips Corporation, has announced the development of a new line of solid electrolyte aluminum foil capacitors. Designated Series 121, these new devices fill the gap between dry aluminum and solid tantalum electrolytics for circuitry requiring long life, high reliability and stability over a wide range of temperatures. With electrical characteristics similar to solid tantalum types, the new Series 121 capacitors

(continued on News Page 6)

LEAKY LINES

David Mann K2AGZ

This is the first time in about three months that I've been able to devote to writing an installment of Leaky Lines, since there has been an extraordinary spate of activity in another phase and another direction. A friend of mine who works for a TV network and I were discussing the horrid and putrid state of television nowadays during a late night 15 meter QSO, and we decided that we might put our heads together and try to come up with some ideas for TV production. We reasoned that it wasn't enough merely to sit on the sidelines and carp about what was lousy in television – that we ought to try to come up with something better. Otherwise we would be the same as the present-day critics of our society who gripe, complain, and tear down everything in sight without proposing something better with which to replace it. Fortunately our efforts appear to be bearing some fruit, and we just might get lucky enough to capitalize on the venture. Never let it be said that I am averse to making money . . . unlike others who feign disinterest, I am very much in favor of large, copious gobs of the stuff, having discovered many, many years ago that it comes in quite handy, especially if you want to keep eating, wearing shoes, buying little goodies for the ham shack, and so forth.

So my friend and I have been rather busy promoting some ideas, and things look promising. If anything catches fire, or begins to jell, there is a strong possibility that we can cash in handsomely.

That, briefly, is the reason I have not been turning out any copy for this space. I gather that in some quarters it has not been missed very much. But there have been some expressions of disappointment relayed to me through on-the-air contact, and for those, I am disturbed by this apparent shift toward FM, away from what is commonly regarded as the prime ham spectrum, 10 through 80 meters. They seem to feel that this area of interest is of little or no importance. I must confess that I too, felt similar qualms when the emphasis on FM began to nudge for attention in the pages of 73. I had the feeling that large segments of the readership were going to begin feeling alienated – that they might not renew their subscriptions – and that this would lead inevitably to a loss of advertisers, who are interested in reaching the largest number of potential buyers, which in most cases meant buyers of HF gear . . . not FM equipment. But little did any of us reckon with the realities of the situation. The fallacy of our thinking is now perfectly evident, for the manufacturers of FM equipment are enjoying high sales volume, and continued growth of repeater activity shows every sign that it is a permanent and major part of amateur radio.

The expressions of reluctance to become involved in VHF-FM on the part of many HF operators is quite reminiscent of the early resistance to single sideband openly expressed by devotees of AM during the period when SSB was becoming *the* voice mode, back about ten years ago. I can recall vividly that sideband signals were characterized by phrases such as silly sideband, stupid sap-band, Donald Duck, quack-quack, suppressed character, and other unflattering terms. But in the long run it became impossible for all but a few diehards, zealots and fanatics to disregard its obvious advantages over AM. And while there are still some AM stations to be heard on the bands today, their numbers are exceedingly small, especially on the prime DX bands. The advent of moderately priced sideband gear in kit form really sounded the final death knell of AM. It was inexpensive, compact, lightweight, very satisfactory in performance, easily maintained and serviced for the most part, and most important of all, satisfied the hams' desire to upgrade into what prompts it. Look at it this way. The use of two meters prior to the current development was limited to specific areas. Round tables within severely circumscribed geographic regions, occasional coastal, tropospheric and meteor shower openings which permitted some limited DX work, experimental operations with moonbounce and some satellite action, a few brave souls trying some RTTY communications, club station activities, some design and construction, some mobile activity, AREC, RACES and MARS, a smattering of CW, and virtually a minimum of SSB activity. But, all things considered, outside of short-range communications, it was a tremendous waste of a huge resource. Just consider the size of that band . . . four megacycles (I just cannot get used to that other term!). That's more than all the HF bands put together and, if properly utilized, could relieve HF bands of a great deal of overcrowding and QRM.

Repeaters have accomplished a tremendous service in this connection. They have obviated the necessity for mobiles, for instance, to try to compete with kilowatt stations on crowded DX bands. They have supplied useful and serviceable channels for communication when other channels have been unusable. They have extended the range of normal operation tremendously. They have added another tool to the amateurs' bag of tricks. They make proper use of a large segment of our allotted spectrum, thus guarding against possible loss through disuse.

These are some of the pluses. How about the minuses?

Frankly, once the illogical objections are dealt with, it is difficult to find any minuses. When people begin voicing baseless prejudices as though they were valid, it does not pay to answer them. If someone actually feels honestly that 2 meter FM operation resembles CB, it is simply useless to try to convince him otherwise, for the very idea of this is downright silly.

On a cost basis this mode is a godsend to both hams and manufac-

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Once again I feel it necessary to call ing with respect to the ARRL recommendation. But I am vitally concerned about the setting aside of a regulation, simply because it might be considered inconvenient or unfair to one group or another. Granted, the proposal does concern a slice of spectrum, redistribution of which might work to the disadvantage of our northern neighbors. But just consider the fact that the total number of hams in the entire Dominion of Canada is not equal to the ham population of New Jersey, or about three percent of the total U.S. ham fraternity. We are then faced with the possibility that a tiny minority could thwart the needs and desires of an overwhelming majority!

In my judgment it would have been perfectly proper for Director Eaton to be permitted to express his views and try to persuade others to cast their votes according to how well he had succeeded in convincing them. But I think it highly improper and even dangerous to set the rules aside in order to allow him an actual vote. Since Canadian interest in this matter amounts to a special interest, and since they presently enjoy phone privileges far in excess of our own, it seems rather ungracious of them to insist upon exclusivity of operation in the foreign portions. And for them to have the right to vote upon the question does not sit very well with me.

I think the Canadian Director would have been well advised to merely express his views, then to disqualify himself from voting, even when the League Council saw fit to set aside the regulation, permitting him to vote.

Perhaps the FCC proposal will indeed lead to American interference with foreign stations, as the Canadians fear. It may lead to some trouble. No one really knows for sure. But I still cannot see any wisdom in permitting those who are specifically disqualified to cast votes in determining the issue. It is a dangerous precedent which could lead to terribly undesirable results.

* * *

I've recently rediscovered the joys of flea power CW operation, using a tiny little rig described by W7OE in an article which appeared a couple of years ago.* This particular transmitter utilizes the small oscillator kits manufactured by International Crystal. It is a band switching affair, 15 through 80 meters. Just to show you what can be done with minute power . . . on 40 meters I hooked up with and worked 27 states and 11 DX countries in two weekend sessions. Of course my 40 meter beam must have helped somewhat, but I'm sure it was not the sole factor.

While it is possible to overdo the thing and become an impossible purist in this QRP business, it is highly satisfying to run reasonably low power and make contact after contact, with good signal reports. I have been running around 1.2W, using a 6V dc supply, and up to 1.7W, using 9V dc. Current drain on battery supplies leave something to be desired, so it would be well to construct small regulated power supplies, and some nice ones are available from Radio Shack, Lafayette or Heathkit which serve very nicely.

I recommend this venture to anyone who feels a sense of purposelessness or whose tastes have become jaded because of the same old operating rut. There are many circuits available, and if you are particularly smitten with the idea, why not roll your own, using contemporary solid state devices. I can promise that you will experience pleasures that will more than repay you for the small effort involved.

. . .K2AGZ

Listed below are recent changes and additions to our comprehensive open-

space. I gather that in some quarters it has not been missed very much. But there have been some expressions of disappointment relayed to me through on-the-air contact, and for those, I am grateful.

During this period I have been able to get on the air with greater frequency, and have spoken with hundreds of fellows who have seemed eager to talk about 73, which surprised me much, because I had very little inkling that so many were familiar with this column. Most of these hams were either anxious to argue about points which had been raised from time to time in the column, or to take issue with what they regard as opposition to ARRL . . . either from me or from Wayne. I had a good deal of trouble trying to make these people understand that disagreements with the programs of the League do not necessarily imply opposition. In fact, they sometimes demonstrate a greater desire to help than to hinder. But we need not examine that question, for it has been hashed over so many times it has whiskers. Suffice it to say that there are hams who feel that nobody should "make waves," and as far as I am personally concerned, it's a waste of breath to try to reason with them.

One of the most persistent topics is Wayne's apparent willingness to ease himself out of activity and turn 73 over to a successor. In the May issue, for the first time, he goes into some detail concerning this, and I must confess that it is a big surprise to me. This presents a golden opportunity to someone, not merely because of the soundness of the investment, but because the magazine is in a healthy condition with respect to its relative position among other magazines in the field. It is preeminent in the VHF-FM sector, having begun coverage of this important phase of the hobby long before any of the others. This is undoubtedly due to the guidance of K6MVH, who came to 73 with a superlative advantage of long concentration on FM.

Upon looking over the correspondence section of the last few issues, however, it is apparent that many are satisfactory in performance, easily maintained and serviced for the most part, and most important of all, satisfied the hams' desire to upgrade into modern components and techniques. The older mode remained more or less locked into the techniques and materials of the past. Most hams are mindful of traditional values, and like to preserve them, but when it comes to equipment, they like to be up to date, if possible.

The most damming thing about AM, especially in the face of increased numbers of phone operators, was the excessively broad space required. It simply did not permit optimum use of our frequencies. Let's face it . . . six or more SSB QSO's can take place in the space required by one AM contact. If for no other reason, it had to be replaced.

Many hams deprecate the current trend toward FM, alleging that it is similar to the business band or CB. This is not accurate, and shows a total lack of familiarity with the subject. No one who hasn't listened attentively to repeater operation should express this view, for it is just plain nonsense. One doesn't judge football on the basis of golf, nor express opinions about food on the basis of drama, nor assess portrait painting using criteria related to mining or agriculture. Yet, many are judging FM within a frame of reference which applies to other types of radio communications. Why make judgments of VHF repeater operations based on HF bands?

This is axiomatic; every time some new development phase occurs, there are grumblings of discontent from traditionalists. Just as the stableman and the blacksmith opposed the advent of the combustion engine auto, and the ignorant masses feared being vaccinated against smallpox, so the old guard always objects to each innovation. As the old farmer is supposed to have observed . . . "Yup! I've seen many changes through the years . . . and I've been agin every one of 'em."

While most of us disagree with this grousing, we can certainly understand

to try to convince him otherwise, for the very idea of this is downright silly.

On a cost basis this mode is a godsend to both hams and manufacturers. There is a veritable bonanza to be found in surplus equipment which can be modified into serviceable state with very little work. The new equipment is representative of a broad price range, well within the budget of the economy-minded, yet offering more sophisticated, higher priced gear for those who can afford it.

All in all, I think you've got to say that the mode has already gone far beyond experiment status and is a viable and valid part of the ham radio scene . . . perhaps one of its most important parts. So – like other developments which have met with opposition before winning general acceptance – this one will come through also. Any advancement, whether or not it meets with the approval of the inertia-bound, will establish itself, for that is the nature of progress. It is irresistible.

* * *

The beginnings of a small brouhaha are fermenting, if indications are not being misinterpreted.

When the ARRL directors held their meeting in May, primarily to take up the question of the FCC proposals concerning redistribution of the phone bands, it had been assumed that they would have to consider the impact of such changes on the Canadian amateurs. After all, there are VE members of the League who deserve consideration and representation, and they have it in the person of Director Noel Eaton.

There is a specific provision in the regulations of ARRL, however, which states, more or less, that in matters relating to frequency allocations for the U.S., the Canadian Director's vote shall not be counted. Since this particular question directly affects the Canadians, however, Mr. Eaton is said to have made a strong pitch for being permitted to vote. And evidently the League Council concurred, because the vote was indeed cast and counted.

Now, I am not concerned in the slightest with the results of the meet-

could lead to terribly undesirable results.

* * *

Once again I feel it necessary to call attention to what has become a damnable nuisance on the lower part of the 20 meter band. Despite letters from some of the KP4's and others, seeking to justify the condition on various grounds, or to minimize its importance, the constant use of our best DX frequencies for phone patch activity has become a thorn in the sides of many DX'ers whose interests are being flouted. I want to make it absolutely clear that I do not object to phone patching, in and of itself. If stations want to accommodate people with this type of service, all well and good. But why in the world must they insist upon using our prime DX frequencies? They can just as easily use other channels without annoying anyone. But no! They insist on getting into the juicy part of the band. Reminds me of a pig in clover.

The other night I counted six of them, between 14.200 and 14.210, and the screaming, FM'ing, caterwauling and overmodulation was horrendous. It seems to me that frequencies might be found that would be a lot more suitable for this activity, and that everyone would profit thereby, including the very stations who wish to participate in it.

One brief cautionary word. Stations running patches are responsible for all transmissions on their equipment. If a patch is being conducted in a foreign tongue with which an amateur may be unfamiliar, it is possible for him to incur serious violations. Remember, you must maintain control of the transmitter, and if the party on the other end is unaware of the limits with respect to content and language, you may run afoul of the regulations, should he exceed what is permissable. Make perfectly sure, before running any patches in other languages, that your party fully understands his responsibility in avoiding questionable phraseology, and to steer clear of business matters, which are strictly prohibited.

Listed below are recent changes and additions to our comprehensive open repeater directory which appeared in April. All our readers are urged to send in corrections to our directory so that future editions will be accurate.

All frequencies listed are in megahertz with input frequency/output frequency.

There is a new repeater operating in Columbia SC on 146.28/146.88 output. Using narrowband gain antennas for receive and transmit and a power output of 35W, they have coverage of about a 40 mile radius. The temporary call being used is WA4MPC.

W4RRW is a new repeater in Smyrna GA (near Atlanta) using 146.28/146.88 output.

W4DOC, Atlanta GA, has a tape recorder logging the first 15 seconds of each repeater key. Users are asked to give time and location (location to aid in evaluation of coverage). On signing off users are requested to let the repeater give its ID and unkey before transmitting your own call and your sign out time. After the last carrier, the timer waits 4 seconds, gives a voice ID and drops out.

WB4PLN, Columbia SC, was incorrectly listed as WB5PLN. WB4PLN is located 18 miles SW of Columbia in Pelion SC. It runs about 100W into an antenna about 165 feet above ground. Transmitter and receiver are about 6 miles apart.

The Council Bluffs IA repeater listed with the temporary call of KØJIU has been issued a permanent call: WAØVVD. Using 146.22/146.82, it covers Omaha NB as well as Council Bluffs IA. It is sponsored by the Council Bluffs Repeater Association.

The Chilliwack (British Columbia) ARC's wideband repeater, VE7ELK, has changed from 147.33/146.58 output to 146.46/147.00.

The Colorado Springs repeater was incorrectly listed as using 146.34/146.94. They actually use 146.16/146.76.

(continued on News Page 6)

CONTESTS

WAEDC

The Deutscher Amateur Radio Club (DARC) has announced the Worked All Europe DX Contest. This is, of course, one of the big contests. Over 5000 amateurs participated in this contest last year, so it certainly ranks as one of the major contests. For this reason we include this summary of the 1971 rules. We suggest, however, that you write to the DARC for complete rules and the WAE countries list.

Time: C. W. August 7–8, Phone September 11–12, Starts 0000 GMT Saturday; Ends 2400 GMT Sunday.

Bands: 3.5 thru 28 MHz

Classifications: Single Operator – All Band; Multi Operator – Single Transmitter.

Rest period(s): The 12 hours rest period for single-Op stations may be taken in three periods.

QSOs: Only between European and non-European stations.

Exchange: RST/RS plus serial number.

Points: Each QSO 1 point, except 3.5 MHz 2 points. Each QTC – given or received – 1 point.

Multipliers: For non-Europeans each WAE-Country. Europeans check to the ARRL countries list + each call area of JA, PY, VE, VO, VK, K/W, UA9/0. 80 meter mult. count three, 40 meter mult. two.

Final score: The final score is the number of QSO points plus QTC points multiplied by the total multipliers from all bands.

QTC – traffic: Non-Europeans report their QSOs back to a European station (max. of 10 to same station per band).

QTC contains: Time / CALL / number received.

Logs: Send S.A.S.E. for free log sheets.

Deadline: C.W. September 15th, Phone October 15th.

Mailing address: WAEDC – Committee, D - 895 Kaufbeuren, Postfach 292, GERMANY.

Logs: (a) Must show in this order: date, time in GMT; call sign of station contacted; band; serial number sent; serial number received. *Underline* each new VK/ZL call area contacted and use a different log for each band. (b) Summary Sheet to show: call sign, name and address (in block letters please) and details of equipment used – and, for EACH BAND: QSO points for that band and VK/ZL call areas worked on that band.

"All Band" score will be total QSO points multiplied by the sum of VK/ZL call areas on all bands while "single band" scores will be that band's QSO points multiplied by VK/ZL call areas worked on that band

Sign a declaration that all rules and regulations were observed.

Awards: Especially attractive coloured pictorial certificates will be awarded to each country (call area for W/K, JA, UA) on the following basis –

(1) Top Scorer using "all bands."

(2) Other certificates may be awarded – to be determined by conditions and activity. There are separate awards for phone and CW.

Listeners' Section: To count for points, a VK or a ZL station ONLY must be heard in a QSO and the following details noted in the log – date; time in GMT; call of the VK or ZL station heard; call of the station he is working; RS(T) of the VK/ZL station heard; serial number sent by the VK/ZL station heard; band; points. Scoring is on the same basis as for the transmitting section and the summary sheet should be similarly set out.

• ALL LOGS SHOULD BE POSTED TO REACH – FEDERAL CONTEST COMMITTEE – W.I.A., Box N1002 G.P.O., PERTH, W.A. 6001 ON or BEFORE 30th JANUARY, 1972.

VK/ZL/OCEANIA DX CONTEST

WIA (Wireless Institute of Aus-

SOCIAL EVENTS

ILLINOIS
SIX METER CLUB OF CHICAGO HAMFEST

The SIX METER CLUB OF CHICAGO, INC., will hold its 14th ANNUAL HAMFEST in Frankfort IL, on Route 45, one mile north of Route 30, on August 1, 1971.

PENNSYLVANIA
MT. AIRY CLUB PICNIC

The Mt. Airy VHF Radio Club, Philadelphia PA, will hold the annual picnic and family day on August 8, 1971 at the Fort Washington State Park in Flourtown PA. More information available from W3FQD, Dick Huntzinger, at 130 Fairhill Drive, Churchville PA 18966.

OHIO
WARREN ARA HAMFEST
AUG. 22, 1971

The Warren ARA will hold their 14th hamfest on Sunday, Aug. 22, 1971 at Yankee Lake on Ohio Rt. 7. There will be picnicing, swimming, prizes, displays, flea market, and a playground. For details and a map send a card to Hamfest, Box 809, Warren OH 44480.

ALABAMA
NORTH ALABAMA HAMFEST

The North Alabama Hamfest Assn. have announced their plans for a hamfest to be held in the cafeteria of John C. Calhoun State Technical and Junior College located north of Decatur on US 31. Write to the NAHA at Box 9, Decatur AL.

NEW MEXICO
NEW MEXICO HAMVENTION 1971

The Amateur Radio Clubs of New Mexico will sponsor the New Mexico HAMVENTION 1971 on September 17, 18 and 19, 1971. Convention headquarters will be the Sheraton Motor Hotel on East Highway 66, Albuquerque, New Mexico. The pro-

DX FOOTNOTES

The Kuwait/Saudi Arabia Neutral Zone (9K3/8Z5) has been deleted from the DXCC countries list. Only contacts made before Dec. 18, 1969 will count. However, the islands forming the Gabal Group (most well known being Zuquar) in the Red Sea have been approved as a new country. The only station to have operated from there recently is ET3ZU/A. The islands are claimed by Ethiopia but the only activity there has been maintenance crews sent to service the navigational aids on the islands.

More and more strange but legal prefixes are being heard. Included in the list are KD4ITU (QSL via W3ZA), WU3SNA (U.S. Naval Academy, QSL via W3ADO), WM8ICH (QSL via W8HS), and a whole bunch of special ITU suffixes from 9Q5, 9L9, 5T3, and 4U3 lands. KC0KC operated from the Kansas City fair. The Iowa State fair will house a station which has applied for WI0ISF or KI0ISF. WD6WD will be the call used at the ARRL National Convention in Disneyland from September 1st through 4th.

The *West Coast DX Bulletin* included the following history of one of the world's most tantalizing DX spots: Interest in Rockall . . . like Clipperton and a few others . . . continues to thrive even though any hopes for an early operation are more wistful than factual. The amateurs in OY-Faroes have from time to time given the rock a look over but they are quick to acknowledge that the problems would be formidable and any success would be largely dependent on the weather and sea conditions.

In 1955 the Royal Navy lowered some men onto Rockall from a helicopter to claim the rock in the name of the Queen. At that time a brass plaque was cemented to the top of the rock. It is reported that prior to WW II, fishermen from the Faroes have made a landing on the rock from a

better dust off the key and comb the 20 meter CW band. All JT cards should go to Box 639, Ulan Bator, Mongolia.

If you need some help hooking some of the real rarities like VK9XX, 9M2GV, or 9M8OEA; look for W5ZD between 1300 and 1400 GMT on 14230 kHz. He's always glad to lend a hand.

Even east coast DXers have a good chance to bag a few Indonesian stations by checking into the YB Net on Sundays, 1340 GMT, on 14257 kHz. Incidentally, YB3AAY (Jess at the U.S. Embassy) needs Delaware and Montana for his WAS. Similarly, 9V1OY (Indonesia) hangs around 21035 kHz CW looking for Maine and South Dakota for his WAS.

AC3PT, the only ham in Sikkim (not to mention the only monarch) has been active on 20 SSB recently. Don't hold your breath for a QSL, however.

Don't waste your time working 3V8AL – he's a pirate. Also, 8R1J has been having a hard time with someone using his call. If you have some doubt while working him, ask him his age. The real 8R1J is 45.

If you think missing a rare one is bad, be glad you are not a member of the OH-group who planned the super-DXpedition to Albania (ZA-land). After securing a license to operate, organizing the transportation, equipment, operators, and publicizing the DXpedition so that everybody could work them, the Albanian beaurocracy stopped their plans. Upon arriving in Albania, the OH-group was met, reportedly, by an armed committee, their equipment was impounded, and they were forbidden to operate. Period. The planning, the paperwork, the incredible expense, the thousands of panting DXers were all for nothing, *even though a license and permission had been granted months beforehand.*

Meanwhile, DL7FT had also planned an expedition to ZA-land. In the face of Albanian hostility to ham operating and the OH-group's expensive failure, DL7FT went to Albania with three other DLs and spent three

NOVICE

There is a newsletter being put out just for Novices and beginners. Ap-

Mailing address: WAEDC – Committee, D - 895 Kaufbeuren, Postfach 292, GERMANY.

HAMVENTION 1971 on September 17, 18 and 19, 1971. Convention headquarters will be the Sheraton Motor Hotel on East Highway 66, Albuquerque, New Mexico. The program includes Antenna Session, SSB, LASER Communications, DX, QCWA, Traffic, VHF/FM, Ladies' Luncheon & Fashion Show, AREC/RACES, MARS, manufacturers' displays, a banquet, speakers, many prizes, a flea market/swapfest. Talk-in frequencies: 3940 - 7255 - 146.94. Contact N.M. HAMVENTION, Box 14381, Albuquerque NM 87111.

of the Queen. At that time a brass plaque was cemented to the top of the rock. It is reported that prior to WW II, fishermen from the Faroes have made a landing on the rock from a fishing boat and reported footing a bit slippery because of the thousands of birds claiming the rock as home. While the rock is rather steep, a crevice on one side gives a difficult but not too difficult access to the top. The RAF Radio Club gave Rockall a prolonged study two years ago but finally gave it up as too expensive an undertaking. Some Northern Europe stations have continued to study a possible approach by sea but here again the costs are the big problem to overcome, after that the actual landing would be the big problem. Rockall is possible . . . should there be sufficient financing . . . but any immediate probability is questionable.

face of Albanian hostility to ham operating and the OH-group's expensive failure, DL7FT went to Albania with three other DLs and spent three days straightening out the license situation. Finally he did get the go ahead and put ZA2RPS on the air for a few days. OH2BH, OH5SE, DL7FT, and the rest of both groups have justly earned the gratitude and admiration of DXers for their great efforts in trying to give us a ZA contact. Thanks!

An occasional zone 23 station seems to be getting through. UAØYT, JT1AI, JT1KAF, JT1KAA, JT2AB, and JT1AH have all been worked by U.S. stations. UAØYT, however, is your best bet for a QSL. If you want to work a JT (Mongolia) you had about this, it is sort of like a Novice band expansion – more QRM free frequencies!

Novices can now have roundtables and nets – QSOs involving more than two stations. Before, unless everyone was lucky enough to have rocks for the same frequency, you would have to retune your receiver to each fellow's different frequency. Now, if you all zerobeat against one station, there is no receiver retuning.

Crystal control for Novices has actually been a throwback to the pre-WW2 era. At that time virtually all hams were crystal controlled on CW. Every CQ would be followed by minutes of tuning up and down the band looking for a reply – necessitating long calls, wasted time, and spectrum waste. When stable VFOs became technically possible and economically practical, crystal control died out almost immediately. It had too many drawbacks;- VFOs had too many advantages. This general ham trend away from crystal control immediately following WW2 should stand as a pretty solid argument in favor of VFO operation.

Venezuela may not be particularly rare, but few DXers have received a QSL like this one from R.A. Carvajal (4M2BC). This is his special QSL for slow scan TV contacts.

KH6EDY on Kure Island (yes, it does count as a separate country) is being operated by John, who is connected with the Coast Guard Loran Station there. He has had his share of rig problems but should be active around 7295 kHz and 14280 kHz.

Keep your eyes and ears open for a West Indies DXpedition in September with W7VRO and W7EKM.

ZC4CB is willing to make schedules with anyone – particularly 40 and 80 meter skeds for next winter. His QTH is Box 216, Famagusta, Cyprus.

(continued on News Page 6)

VK/ZL/OCEANIA DX CONTEST

WIA (Wireless Institute of Australia) and NZART (New Zealand Association of Radio Transmitters) invite all amateurs to participate in this year's VK/ZL/Oceania DX Contest.

When? PHONE: 24 hours from 1000 GMT Saturday 2nd October to 1000 GMT Sunday 3rd October. CW: 24 hours from 1000 GMT Saturday 9th October to 1000 GMT Sunday 10th October.

Scoring: (1) For Oceania Stations other than VK/ZL: 2 points for each QSO on a specific band with VK/ZL stations; 1 point for each QSO on a specific band with Oceania stations other than VK/ZL. (2) For Rest of World other than VK/ZL: 2 points for each QSO on a specific band with VK/ZL stations; 1 point for each QSO on a specific band with Oceania stations other than VK/ZL.

Final Score: is derived by multiplying total QSO points by the sum of VK/ZL call areas worked on all bands. Note: The same VK or ZL call area worked on different bands counts as a separate multiplier.

Serial Numbers will consist of five or six figures, made up of the RS(T) report plus three figures which should commence with 001 and increase by one for each successive QSO – 002, 003, etc.

ROCHESTER HAMVENTION

Here are some shots of a few of the fellows who subscribed to 73 Magazine at the Rochester Hamvention last May. If you're not careful at these conventions, you too might appear in 73!

There is a newsletter being put out just for Novices and beginners. Appropriately named THE NOVICE, it is put out by Greg Ginn (WB6ZNM) and appears monthly with news of Novice traffic handling, Novice nets, FCC actions as related to the Notice, contests, awards, letters, product reviews, and dozens of simple but handy construction projects. It is a big job that Greg is trying to do in putting out THE NOVICE and he would like to get more Novices involved in both reading and writing for THE NOVICE. You can get a sample copy to see for yourself by sending a self-addressed stamped envelope (SASE) with 16¢ postage on it to Greg Ginn, 1240 23rd Street, Hermosa Beach CA 90254.

NOVICE VFO?

QSY anywhere in the Novice band? Sound good? Well the Microcomm people have gone and not only designed, but gotten FCC approval for a Novice VFO!

Not actually a VFO (variable frequency oscillator) in the truest sense, the new unit is actually a VXO (variable crystal oscillator) employing two crystals. After a half year of correspondence with the FCC, Microcomm was finally granted typed-acceptance by the FCC. This is a "first" in amateur radio, although it is a standard practice with commercial and CB equipment. It means, simply, that the equipment as designed and manufactured meets the FCC rules concerning frequency stability – but that modification to the equipment is illegal. It would seem that this is a compromise of the ham spirit and ham initiative for the benefit of the flexibility of VFO operation.

NEW JERSEY SJRA HAMFEST SEPT. 12, 1971

The South Jersey Radio Association has announced plans for their 23rd annual hamfest on Sunday, Sept. 12, 1971 beginning at 11 AM. Talk-in planned for 3.930, 50-3, and 145-3 MHz. For details and directions send an SASE to the SJRA, Box 909, Sicklerville NJ 09081.

In his petition to the FCC, Jim Shaddox (W6BVE), president of Microcomm, mentioned about a dozen reasons why Novices should be allowed to use VFOs. Among the less obvious reasons was spectrum conservation. At present, if your rock is for 3725 kHz and the fellow you're working is on 3730 kHz you are effectively using two channels to communicate. There are two channels being used so that nobody else could use either one of them without running into some QRM from one of you. If you and the fellow you're working could both get on the same frequency (by zerobeating with the VFO) – say 3725 kHz – you have effectively freed one frequency. When you think

THE 1971 ARRL BOARD MEETING

With comments by a former ARRL Director, A. David Middelton W7ZC/W5CA

The annual meeting of the Board was held May 7 and 8 in Hartford. Attendance totaled thirty-seven, including all sixteen directors, nine vice directors and a mixed bag of HQ and other personnel. The Board was in session for sixteen hours and fifty-two minutes.

Prior to each such meeting there is much expectation that "this time something will actually be accomplished" by these elected officials at their once-a-year gathering.

A sage once said, "Hope springs eternal . . . ." This time was no different! The minutes of the 1971 meeting indicate that little has changed. The Board met, discussed and, for the most part, took little positive action on matters of importance to amateur radio.

Some decisions were made but a total of fifteen measures were "referred to committee," a process that can be and usually is the death of a good idea, as they are seldom heard from again.

In the main, the Board was as reactionary as ever, and that is bad news for thinking amateurs who are always desirous that ARRL will some time act in a manner beneficial to the amateur body politic as well as for their membership still left on the rolls.

What follows is a summary of measures brought up and how they fared. I offer comments from a background of over fifty years of active hamming and observation of the ARRL's modus operandi, including four years as a militant director and eighteen months as a member of the HQ staff. I have no inside dope and am not privy to any Board matters except what I read in the minutes, and with suitable "reading between the lines" based on previous study of such records, and having "been there" for four of these sessions.

ARRL vs FCC

Item 35: A motion was made that FCC should request authority from Congress to permit FCC to establish interference rejection requirements and apply them to the manufacturers of TV and other home entertainment equipment. This motion was shot down by an amendment *referring* the matter to the General Counsel to file comments on Docket 19183 with reference to adoption of standards, etc.

For some obscure and long prevailing over-biased reason, the ARRL Board and HQ always back off on anything relating to the elimination of TVI and similar problems! Those who recall the early 50s and the terrible HAM vs TVI fight, may remember that it took drastic directorial action to force ARRL to publish the facts about the "Dallas Plan," the weapon that finally broke the back of the TVI problem. That was in 1951. It is now twenty years later, and still ARRL is reluctant to take a stand against this plague to ham radio.

Item 37: An effort made to request FCC to consider a change in the practice of examinations, to permit applicants to take the theory test before the code test (and other matters) was *referred* to a committee by an amendment.

Item 40: The so-called "Grandfather clause" and other matters pertaining to the Extra Class license was debated and then the Board moved to stand pat on their 1969 decision (items 23 and 54, July 1969 QST minutes). See those items for the full details.

Items 41 and 43: The "Eye Bank situation" and FCC 19245 was discussed and, in Item 43, it was requested that FCC reconsider its interpretation of Section 97.39 of Rules and authorize emergency frequencies during major disasters, and that such situations be publicized over W1AW and ARRL OBS.

$3000 and would limit that committee's actions to implementation of policies established by the Board.

The Executive Committee appears to continually usurp the authority and prerogatives of the Board, but apparently the Directors approve of such procedure, by defeat of this motion.

Item 55: A motion (later *withdrawn* by its instigator) would have had a study made of the organization and operation of HQ.

Such naivete! This director did not know that *any* investigation of HQ is a no-no!

Item 57: Still trying – Director Shima (See Item 55) moved that the General Manager should present to the Board at the annual meeting a three-year operating plan for HQ, outlining his future plans for financial, manpower, publication and membership services and capital expenses. This excellent motion was *referred* to a committee.

Item 58: After years of discussions, Article 7 was amended to read, "Should the office of Vice Director be vacant, the vacancy shall be filled by appointment by the President."

There is no logical explanation why this was not done years ago!

Item 71: HQ was directed to prepare a Special Techniques Handbook – featured sections to include RTTY, ATV, repeaters, Space Comm., facsimile, etc., with a target date of '73.

If the required manpower and funds are made available, and if this is followed through, such a Handbook might be valuable. However, with the state of the art changing so rapidly, devotees of these phases of hamming may better find their data in the pages of ham magazines and up-to-date handbooks published by other groups.

Item 72: A motion (*later tabled*) would have moved W1AW frequencies to points in the General Class segments.

The Board and Board Matters

Items 14 and 15: Article 4 (of the Constitution and By Laws) was amended to provide for two yearly meetings of the Board, one to be held in conjunction with the Annual Meeting of the membership, and the other at such time and place as the Board may determine. The Executive Committee was directed to study the matter and report back to the Board.

Item 16: Article 5 (of the Constitution and By Laws) was amended to provide that the Executive Committee shall consist of the President, Vice President, Secretary, Treasurer and two Directors elected by the Board.

Item 17: Article 6 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 18: Article 8 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 19: Article 9 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 20: Article 10 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 21: Article 11 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 22: Article 12 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 23: Article 13 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 24: Article 14 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 25: Article 15 (of the Constitution and By Laws) was amended to provide that the Vice Directors shall be elected by the Board of Directors.

Item 26: Rules 4 and 5 (Constitution and By Laws) (concerning affiliated clubs) were changed and they now require at least 51% of the voting members of a club to be Full or Associate Members of ARRL, and at least 51% of the members of a club be licensed amateurs, etc.

Item 28: This motion grants full membership in ARRL to a person who has held continuous and unlapsed membership in ARRL since May 15, 1934, as well as those already previously covered through license and residency.

Item 33: Director Griggs offered a motion (later *tabled*) that a committee study the feasibility of realigning ARRL divisional boundaries or by weighting the voting power of directors.

Only three directors *opposed* tabling this plan to strengthen ARRL through proper and equable representation.

Item 53: A motion "to take from the table" the realignment motion (Item 33) was *rejected*.

Item 54: In the opinion of one director (Griggs) there should be an annual opinion survey of ARRL members conducted by HQ in QST.

The vote on this poll was one YES, and eleven NO (there are sixteen directors, remember?). Why does the ARRL hierarchy maintain this ridiculous fear of polling its membership?

Item 60: A motion was made to have ARRL publicize in QST, the CQ-magazine sponsored WW DX and WPX contests. This was amended to *refer* this matter to the General Counsel for study. The ARRL has apparently never heard of the act of reciprocity!

Item 59: A motion (later *defeated*) was made to provide one-half page space for each of two directors in each issue of QST, with rotation of the directors to be alphabetical, by division, with the author identified.

AARL Board and Hams At Large

Item 50: The General Counsel was directed to assist, as much as possible, the Counsel of the Chicago Area Radio Club Council, in efforts to establish the right of licensed hams to operate their stations in Chicago.

Item 51: A motion was *passed* that directs HQ to purchase the Dave Bell Association film "THIS IS HAM RADIO" and to make it available to schools and clubs.

This is a new (15 minute) film produced by Bell, W6BVN, at his own initiative following the highly successful reception given his "HAM's WIDE WORLD" film.

Item 89: A committee was directed to make a study to determine the feasibility of again placing QST on sale on newsstands.

The availability of QST among the numerous other hobby-type magazines should publicize ham radio and ARRL. Many potential hams have been denied QST by HQ pique with the newsstand distributors.

The ARRL Board and Public Relations

Item 45: A motion was made (later *referred* to a committee) to establish an advisory committee on PR to foster liaison between the ARRL PR consultant and the hams.

ARRL's PR Consultant is a non-licensed person, but his published work denotes considerable savvy concerning ham radio. All efforts to have HQ provide wider PR seem futile.

* * *

The Board took the usual steps, common to all such meetings, such as resolutions, discussions of pension plans, etc., ad nauseam.

Readers are urged to study the published minutes in July QST, to obtain *all* the information given out on this meeting.

As to *results* of these deliberations, only time will tell.

W7ZC/W5CA■

CARTG RTTY CONTEST

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The Board and Board Matters

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W7ZC/W5CA■

ARRL vs FCC

Items 9a through 9e: After over three hours of motions, amendments and discussion, ARRL's stand on Docket 19162 emerged with a differing view on voice band expansion from that proposed by FCC. ARRL's proposal is –

3775–4000 kHz for Extra Class (25 kHz *less* than 19162)

3880–4000 kHz for Advanced Class (25 kHz *less* than 19162)

3825–4000 kHz for Cond. and General Class (50 kHz *more* than 19162)

ARRL agreed with 19162 on 40, except that ARRL wants 7075–7100 kHz voice for *all* classes of licenses for Region III possessions *only*.

ARRL disagreed with 19162 on 20 and proposes –

14175–14350 kHz for Extra Class (25 kHz *less* than 19162)

14200–14350 for Advanced Class (25 kHz *less* than 19162)

14275–14350 kHz Cond. and General Class (25 kHz *less* than 19162)

ARRL did not offer a rebuttal on the 15-meter voice expansion.

ARRL opposes *all* of the FCC proposed changes on 10 meters and also opposes the cut from 25 to 10 kHz for the special CW segments.

The foregoing ARRL stand appears to be a compromise between the reactionary and the realistic factions on the Board. The minutes contain no details as to the logic (?) behind their stand, but it adopted after a 14–1 vote. Canadian Director Eaton voted NO, and Director Strieter abstained.

A rhubarb developed when Eaton's voting was challenged. The voting of the Canadian, on what is obviously a matter strictly internal in the U.S., was challenged on two occasions, but both times the Chair (Pres. Denniston) after discussion with the General Counsel ruled that the Canadian Director *could* vote.

Item 11: The General Manager and Communications Manager were directed to examine the possibilities of strengthening liaison between FCC field offices and ARRL to declare that FCC reconsider its interpretation of Section 97.39 of Rules, and suggested modifications of Rule 97 to guarantee continuation of policies and interpretation of the Rules, pertaining to message handling and other matters.

This "Eye Bank Net" situation should be the subject of an in-depth study, as it has not been fully explained in any ham magazine. FCC's 19245 may have far-reaching effects on amateur radio.

Item 44: A motion that FCC be requested to change classification for Technicians to TECH I and TECH II (Experimenter and Communicator, respectively) was amended to *refer* this to a committee.

Item 56: A motion (later *referred* to a committee) proposed that FCC establish an FCC-Certified Volunteer Examiner program (for persons residing more than 75 miles from an FCC quarterly examining point.

Item 80: A motion requested the General Counsel and the Executive Committee to study the status of the 220 MHz situation and proposals for appropriate action. Why the Executive Committee?

Item 84: A motion to request FCC to reduce the code speed for General and Conditional examinations to 10 wpm was *referred* to a committee.

Item 91: A motion (also *referred* to committee) called for the establishment of 50.050 to 50.1 MHz for Technican and higher class license CW operation.

ARRL HQ Affairs

Item 36: The Board directed that the General Manager identify in his quarterly report the expenditures of ARRL funds for operation of ARRL QSL services, defense of ham frequencies, foreign travel, legal services and the cost of ARRL support to special programs such as the Talcott Mountain Science Center, AMSAT, etc.

Item 39: A motion was *defeated* that would have restricted expenditures by the Executive Committe to Constitution and By Laws) was amended to provide for *two* yearly meetings of the Board, one in January and one in July, to start in '72 – both meetings to be held in the vicinity of ARRL HQ.

This long-overdue change to two meetings a year was opposed by one director, and another abstained from voting on this measure, which, if followed through, will result in better control of ARRL affairs.

Item 20: For the first time, the existence of *former* Directors was recognized when a motion was *passed* to provide copies of all Director's letters (published at HQ) if annually requested by them.

As a member of this large but hitherto ignored "club" I am appreciative of this gesture by the existing officials.

Item 23: A study (by a committee) will be made of Board meeting procedures.

Item 81: A motion was made to revoke authorization for Directors' expenses to ARRL National conventions. This was amended to *refer* it to a committee. Such penurity is noticeable in some Directors!

Item 86: A motion to hold the January '72 meeting in Miami (to coincide with the S.E. Div. Convention) was *rejected*.

How could anyone deliberately choose to travel to Hartford instead of Miami in January!!!! BRRRR!

The Board and ARRL Membership

Item 16: Raising the dues to $7.50 was "moved." but amended to be *referred* to the first '72 meeting of the Board.

Items 22 and 32: A motion made to establish a "Legal Advisory Committee" was *tabled*. This was reinstated in Item 32, the name changed to "Legal Counsel Committee," and *passed*.

Item 24: A motion was made to have a committee *continue* its study of ARRL election procedures.

This "continuance" is a stalling ploy. It prevents any *action* being

What better purpose could the pages of QST serve than to have them air the views of the elected representatives. As I was denied access to the pages of QST when a director, I am disgusted with the rejection of this motion. Surely directors must have *some* views on *something* Could it be that they just hate to sign their name to anything and be committed to a stand?

Item 69: A motion, passed ten to six, now permits any member to request mailing of QST via first-class mail – if *he* is willing to pay the extra cost.

Item 70: A motion (later *tabled*) would have offered newly licensed Novices membership on a one-year one-time basis for $4.

Item 75: The Board *voted* that the activities of the ARRL Foundation Committee remain in status quo until otherwise directed by the Board.

The delay is inexplicable. What activities?

Item 73: A motion was made that HQ investigate the availability of actual films and tapes showing ham participation in disaster communication for use in documenting the hams' public service. Believe it or not – this harmless little direction was amended and *referred* to a committee!

The Board and VHF

Item 31: A committee was directed to make a study of VHF repeater standards, frequencies and related items.

Item 74: The ARRL Technical Merit Award for 1970 was made jointly to WB6NMT, K2CBA and W7CNK for their efforts resulting in the first 220 MHz EME QSO.

As the originator of this award, I am pleased to see it go to VHF-minded hams once again!

Item 80: The status of the current 220-MHz proposals was referred to the General Counsel and the Executive Committee for study and appropriate action. There's that ubiquitous Executive Committee again!

CARTG RTTY CONTEST

OCT. 16–18

The Canadian Amateur Radio Teletype Group has announced the 11th RTTY DX "British Columbian Centennial" Sweepstakes for the weekend of Oct. 16–18. The rules and scoring are too lengthy to include here, but they can be obtained for a SASE to the CARTG at 85 Fifeshire Rd., Willowdale, Ontario, Canada. The contest looks like a real good one with an emphasis on DX and Canadian QSOs. There is a long list of impressive medallion and plaque awards including special awards for QRP, SWL printer, 10 meter activity, and "Green RTTYer" – anyone who has never participated in a RTTY contest.

TRI-STATE PICNIC SEPT. 19, 1971

The R.I. Swamp Yankee ARC and the Eastern Conn. ARC have announced their Tri-State Picnic for Sept. 19, 1971 beginning at 9:30 AM. Meeting at Pulaski Park, West Gloucester RI, plans call for a trunk equipment sale and picnic. Talk-in will be on 50.35 MHz.

WASHINGTON STATE AWARD

The Puget Sound Council of Amateur Radio Clubs will issue an operating achievement award signed by Governor Daniel J. Evans, for contacts made during Washington State Amateur Radio Week, September 4th to 12th, 1971. Out-of-state amateurs must work ten Washington stations, and in-state amateurs must work twenty other Washington stations during this week. Send list of stations worked, their locations, date of contacts, your name, call and address to: The Puget Sound Council of Amateur Radio Clubs, 12306 80th Avenue East, Puyallup, Washington 98371. An SASE would be appreciated.

REPEATER UPDATE

(continued from News Page 3)

New repeater activity in West Virginia includes W8JDJ on 146.34/146.76. They have a coverage of about a 50 mile radius of Wheeling WV. Atop a 125 foot water tower in Weirton WV is K8ZPR. They cover about a 65 mile radius using 146.34/146.76.

There is a complete revision of our repeater listing for Philadelphia PA. WA3IGS and K3ZTP should be deleted. WA3BKO – the Philadelphia intercity repeater – has been expanded to include operations on 146.22/146.82 (south-east), 146.28/146.88 (north-west), 146.16/146.76 (central), and 146.34/146.94 (west). Also in the Philadelphia area is WA3KUR, listed incorrectly as 52.76/52.525 and 52.76/52.64. They presently operate two repeaters (cross connected) on 52.76/52.64 and 448.8/443.8. There is also an AM repeater, W3QV, on 29.64/29.493.

The repeater listed in our New Jersey listing as "Call unknown (Ford NJ)" has been identified as WA2UWO. This repeater and the separate listing as WA2UWO (still in the NJ listing) are *not open repeaters*. This is quite a repeater with 6 meter, 2 meter, and 450 MHz interconnections along with the use of CTSS. Those interested might write to the NJ FM Asso.c., Box 276, Fords NJ 08863 concerning membership and use.

The repeater listed as WA1KEK, Bridgeport CT, is actually WA1KGK in Trumbull CT. It is tape logged and users are requested to give time at the start of their transmission. Also, its power is 60W out and not the 400W listed. Antenna elevations above sea level are 845 feet for the receiving gain antenna and 720 feet for the transmitting groundplane.

WA2SUR is a super-machine in Manhattan NY previously listed as K1TKJ/2. Transmitting antenna is at 720 feet, and receiving antenna is at 865 feet. Runs 400W on 146.19/146.73. Coverage includes

it. I rented a motorcycle as his place is about 9 miles out of town. It was quite a difficult ride out there. I've never driven a cycle over rough roads and I had to pick my way over chuck holes and large stones. It was a beautiful drive. The green of the rice paddies is a green you never see at home. Bare-breasted women doing their wash in the streams. The road choked with people, cows and buffalo. The school itself is set at the very end of the valley – large green hills rise on all sides. There are 300 boys there. I talked with some and they seem to like it very much. After a short wait Father Moran arrived accompanied by 2 other Americans and a British chap. He didn't show any recognition of your call sign or your letter but did remember that you'd helped him talk to his brothers in the past. Since it was about 1 PM Nepal time USA was closed. But you couldn't believe the European contacts he had. Within a space of 20 minutes he worked Russia, Japan, Germany, Italy, England, Spain, Norway, Sweden, Yugoslavia and Jerusalem. He carried on a conversation with us while he was making his contacts. They all talked too long, telling him about their rigs, etc. He tried to keep transmission short. There were so many waiting. He started out with a Russian and when he finished there was so many calling he couldn't hear anyone. So with a mischevious grin on his face he would shout "Everyone up 5KC." That usually spread them out enough so he could pick up someone. Often he just tuned away from the group. Once he picked up a lone Swede calling CQ. The guy was obviously a new ham and quite amazed. Couldn't figure out quite what Moran's QTH was.

He showed us his two favorite cards – one from Ulan Bator, Outer Mongolia and one from Jordan. King Hussein's card is an understatement – very simple – lists his equipment, gives his QTH as "near Amman." He fills in the back himself, as you do.

I'm sorry that I can't remember what kind of equipment Moran had. Some transmitter I didn't know very

NEW PRODUCTS

(continued from News Page 2)

offer higher reliability than either dry aluminum or solid tantalum types.

Unlike solid tantalum or dry aluminum types, Amperex claims their new capacitors can tolerate substantial reverse voltages continuously. For short durations, they can withstand reverse voltage equal to the rated voltage. In addition, the special construction results in high ripple current capability. With no limit on the magnitude of discharge current that can flow, the need for protective series resistance in associated circuits is eliminated.

According to Amperex, reliability tests of 2647 of the new capacitors for a total of over 26 million component hours and 400 million hours of actual field tests demonstrated failure rates lower than 0.1% per 1000 hours of operation at ambient temperatures of 85°C and at maximum operating voltage. Amperex reports that there were zero catastrophic failures in the entire test program.

The electrolyte used in these capacitors is manganese dioxide. Since there is no loss of electrolyte by evaporation at high temperatures, the capacitive element has good long term stability. Because manganese dioxide has very low temperature coefficients, the capacitor is highly stable at operating temperatures between –80°C and +125°C.

Series 121 capacitors are encased in aluminum for mechanical rigidity and insulated with a transparent sleeve. The capacitive element has high humidity tolerance, as shown by the 56-day damp heat test (40°C at 90 to 95% RH) which produced no change in leakage current and a minimal change in capacitance, loss factor and high frequency impedance.

Series 121 solid electrolyte aluminum foil capacitors are available in six standard case sizes from 2.2 to 330 microfarads and from 6.3 to 40.0 working volts. They are priced competitively with solid tantalum types. *Amperex Electronic Corporation,*

NEW BEAM LEAD OP AMP

With the rapidly expanding use of custom hybrid technology in all types of sub-assemblies for military, medical, industrial and communications equipment, IC chips will find expanding usage. Motorola claims that in applications where system failure cannot be tolerated, the extra reliability of the beam lead system represents a significant improvement of standard IC chips.

The beams are cantilevered gold structures extending from the chip, which bond readily to a gold-metallized substrate replacing the usual fragile connecting wires and providing one of the most reliable interconnection systems known. The chip is mounted in an inverted position with the beams providing both mechanical mounting and electrical connection.

As an additional step toward total reliability, chip separation is done by an etching process eliminating possible fissures caused by mechanical stresses, involved in other chip separation methods.

The new Motorola MCBC1709 and MCB1709F beam lead devices are electrically identical to the industry standard MC1709 op amp, but their unique mechanical structures spell the difference. Both of these full military temperature range parts are protected by a layer of silicon-nitride passivation which is impervious to device degrading ions.

The MCBC1709 is a beam lead chip suitable for hybrid circuits while the MCB1709F is a beam lead chip housed in a flat package, providing the user, not able to handle IC chips, with reliability advantages of the beam lead concept. *Motorola Inc., Semiconductor Products Division, P.O. Box 20924, Phoenix AZ 85036.*

NEW BOOKS

SPRAGUE CAPACITORS

LETTERS

advised by my lawyers that
ou goons don't ever proofr
b
ch
you ignored my comments in
I insist that you print ev
should be boiled in oil ov

Cincy Stag Hamfest

The 34th Annual STAG Hamfest will be held on September 26, 1971 at Stricker's Grove, Compton Road, Mt. Healthy, Cincinnati, Ohio. Door prizes each hour, raffle, flea market, model aircraft flying, and contests. $5 cost covers everything. For further details contact:

John H. Bruning W8DSR
6307 Fairhurst Avenue
Cincinnati OH 45213

Omission

How come you do not have us listed under "PREAMPS" on page 50 of the July, 1971 issue of *73 Magazine*?

AEROTRON
Stuart F. Meyer
P.O. Box 6527
Raleigh NC 27608

Stu, it beats me! We know perfectly well that you make a great preamplifier. Put it down to a sudden stroke of idiocy, okay?

. . .Wayne

Are We Really Losing 220

Once in a while a proposal is introduced that needs the support and planning of amateur radio. The proposal in question is RM-1633. This would allow the Citizens Band operator to become an amateur in a way that should induce him to progress in the amateur ranks. Now some of you are going to say that I'm giving away the amateur bands. Not really, because the FCC is the only one who can do this in reality. For the real truth of the matter is that we are on the verge of losing a great deal of spectrum unless we do something about it.

Now the point comes to light that 220 would sound like a madhouse and be completely useless if we let the CBers on the band. I don't think so. I believe that the CBer can do a lot for

K1TKJ/2. Transmitting antenna is at 720 feet, and receiving antenna is at 865 feet. Runs 400W on 146.19/146.73. Coverage includes most of Long Island, southwestern Conn., and north and central NJ.

DX FOOTNOTES

(continued from News Page 4)

There is a strong chance for a Fanning Island DXpedition by WA5DYW (ex-6O1KM). Dates have not come out yet, but keep alert. And while listening around, don't forget Darlene (VK5DK, WA6FSC, ZL1ATC) on her two year journey through a dozen countries. By now, you should have worked her from Rodriguez. QSL through VR5SK.

If you are looking for Amsterdam Island, look for FB8ZZ, between 14.030 and 14.040 MHz. Real bad pileups tend to frighten him away, but if you do work him you can QSL via F8US.

A reminder about the Arabian Net: check in is at 1900 GMT, Thursdays on 14.295 GMT. A list is made of those checking in and then the list is run through on Saturdays at 1900 GMT on the same frequency.

Last month it was mentioned that Jim (ZM7AG) on Tokelaus was adept at rapid QSYs. It seems that this is the understatement of the century. The *WCDXB* has hinted that many of the W6-land big guns are installing water-cooled VFO bearings just for chasing Jim.

If you are looking for Formosa you won't have to do much tuning around – BV2A is crystal controlled on 14.023 MHz. The only active ham on the island, he is reportedly active around 1200 GMT.

Don't forget the free subscription to 73 for submitting a usable DX station photo to DX Footnotes, 73 Magazine, Peterborough NH 03458.

This letter was written by Terry Jones to his dad Dewitt Jones, W9WKU.

Kathmandu, Nepal
April 3, 1971

Well I've just returned from Father Moran's and I must tell you all about what kind of equipment Moran had. Some transmitter I didn't know very well with a 1000 W linear very much like your small one. Has a 6 element "Hi Gain" Beam at 5,000 ft.

He mentioned that since all his European contacts go over Russia he has to keep on good terms with them.

I left him a message to give you if he worked any W9's. I didn't really feel I could ask him to contact you just for me. Especially since it meant getting up at 6 AM (for him). Besides it cost me $6.00 to rent the bike!

CQ KA CQ KA CQ KA

The Far East Auxiliary Radio League (FEARL) has announced a frequency and time change for the "KA Net." They are now on 14.300 MHz meeting Sundays at 0001 and at 1200 GMT.

FEARL is composed of amateur radio licensees assigned to United States Forces in Japan. The purpose of FEARL, and the "KA Net" which they sponsor, is to promote international goodwill and friendship through the medium of amateur radio.

FEARL offers a series of awards to appeal to the rag chewer, DXer, and SWL. There are awards for working 5, 15, and 25 KA stations and for working all KA call areas. These awards are open to SWLs, too. There are also awards for a 30 minute or an hour QSO with a KA station or a roundtable QSO with at least two KA stations.

The "KA Net," of course, is a good place to begin working for these awards. The Net, although not a DX or traffic net, does attract a few DX stations. Primarily it is to provide KAs and anybody else with some good rag-chews.

IRISH DXPEDITION

Region One of the Irish Radio Transmitters' Society will hold a DXpedition to Dalkey Island, a small island off the east coast of the Republic of Ireland. The gear will all be run from gas generators. Operating times will be from 1200 GMT 31st July until 1200 GMT 2nd August. CW and SSB will be used on all bands, 3.5 to 30 MHz. The call, EIØDI, will be used. A special QSL card will be sent in confirmation of *all* contacts. QSL address is Box 462, Dublin 9, Ireland.

Amperex Electronic Corporation, Component Division, Hauppage NY 11787.

NEW POWER TRANSISTORS

TRW Capacitor Division has announced a new family of industrial - commercial NPN power transistors featuring high power and high current capabilities. They are intended for use in a wide variety of applications including power switching circuits, audio amplifiers, series and shunt regulators, driver and output series, DC to DC converters, inverters, and solenoid/relay driver service.

The manufacturer claims high power dissipation, excellent secondary breakdown characteristics and very low saturation voltage all combined to give these devices high performance and optimum reliability. The transistor is avilable in a hermetically sealed TO-3 case whose copper base acts as an excellent "built-in" heat sink. Lower power devices are available in a TO-66 case. Prices range from $1.40 to $9.00. *TRW Capacitor Division, Solid State Operation, 112 West First Street, Ogallala NB 69153.*

working volts. They are priced competitively with solid tantalum types.

NEW BOOKS

SPRAGUE CAPACITORS

An expanded and updated edition of a comprehensive *Twist-Lok* and *Print-Lok* Electrolytic Capacitor Replacement Manual has just come off the press, announced the Sprague Products Company.

Expanded to include more set suppliers not found in the previous edition, Manual K-110 covers over 300 different makes including TV sets, home and auto radios, high fidelity equipment, and CB radios manufactured through 1970.

The 40-page manual lists original part numbers for each manufacturer, followed by ratings, recommended Sprague capacitor replacements, and list prices. More than 2500 electrolytic capacitors are listed.

Manual K-110 is available free from Sprague distributors, or may be obtained by writing to *Sprague Products Company, 517 Marshall Street, North Adams MA 02147*.

GENERAL CLASS LICENSE GUIDE

The Study Guide for the General Class License nearing completion in this issue of 73 Magazine has been published in book form by TAB Books. Available in either paperback or gold-embossed hardcover editions, the Amateur Radio General Class License Study Guide was put together by the staff of 73 and designed to provide an understanding of the license exam questions, not just an easy means to memorizing. Judging from the results achieved using 73's Advanced and Extra Class Study Guides, this approach works like a charm. If you have been following the installments in the magazine, here is your chance to get it all together in a handy single volume. If you have your General ticket, this book will be invaluable as a refresher course on theory and practice or as a gift to any deserving Novice. Paperback edition, $4.95. Hardcover, $8.95.. *TAB Books, Blue Ridge Summit PA 17214 and 73 Magazine, Peterborough NH 03458.*

be completely useless if we let the CBers on the band. I don't think so. I believe that the CBer can do a lot for ham radio. Unfortunately (for ham radio that is) the truth of the matter is that the CBers can, and more than likely do, outshine us in the art of radio communications. The CBer can handle traffic quicker and better than his ham counterpart. This has been proven in the past and will be proven in the future. That is a sad state of facts.

Second; ham radio needs new blood. We have not grown in 10 years! That, my friends, is a fact. I truly and sincerely believe that the use of the 220 band by amateurs and the Hobby-class licensees (CBers) will benefit all concerned. And it will help populate a band that has but a few users.

Also a point that should be brought to light is that the manufacturers of ham equipment will profit by this new proposal, too. I'm sure that everyone is aware that the manufacturers are giving up on ham radio, except in the field of FM transceivers. Now, let's get down to the nitty-gritty. The 220 band is five Megahertz wide. I would like to propose that on a national basis that these subdivisions be used to eliminate confusion.

1. That 220.0 to 220.100 be used for CW only.
2. That 220.100 to 220.500 be used for SSB/AM/CW.
3. That repeaters be allowed in only one portion of the band and that it be from 223.0 to 224.0.
4. And that a sub-band be set aside for controlling repeaters from 224.500 to 225.0.

There is a 20 kHz space between ch. 75 and 225.0 MHz band edge. Channels 1 to 66 are for the hobby class sub-band. Between Channels 42 and 58 is the repeater sub-band. This would be for the use of amateurs and hobby class. Between Channels 67 to 75 would be for the use of repeater control. As stated before, this is to serve to eliminate any mass confusion, and to show the FCC that we as amateurs can control what happens on our bands. *Undoubtedly*, some will say that the existence of TV Ch. 13 will all but eliminate any useful ham

(continued on News Page 7)

(continued from News Page 6)

activity on 220. I see no reason why the amateurs can't share these channels for use in Channel 13 country. It would be basically like 2 meters. A lot of AM boys are on 146.25 which is in the FM region, and to my knowledge they get along fairly well. I see no reason why this would not work on 220. In conclusion, I would like to say that the future of ham radio is on us all, and that we must make decisions that will better ham radio for all of us.

If anyone wishes to write to me, either expressing an opinion for or against this, or if you have any suggestions to improve this proposal, please drop me a line and let me know. I would especially like to hear from the repeater people and the others who use 220. I would sincerely like to hear from all of you. My address is: 16032- 14 Ave S., Seattle WA 98148. Remember; only you can save amateur radio.

Michael D. Payne WØLVJ

Join the Ranks

Please enter my subscription to 73 for a year. I have let my membership in the ARRL expire, at least temporarily, in protest to "incentive licensing." This is because of my concern for its long term effect on amateur radio, and not sour grapes. I have the Extra class.

Forrest O. Burk W4JFQ
353 Coral Drive
Cape Canaveral FL 32920

Some Have It Made

I remember reading in 73 a few issues back where you wanted the

be a pleasure to newcomers. Also a simple unit, and cheap, might encourage them to try ham radio. One doesn't need a mint to have fun. Nor should one be an engineer to get started. I started my ham ticket in 1938 with a type 76 super regen transceiver on six meters, with loop modulating the antenna power and a carbon mic. with a 21" vertical, and it works.

The fun is partly lost and many potential hams are lost because it is power and big cost units. Small, simple tube and transistor sets, one each month, might attract the potential ham.

Joe Horvath W8QKA
4394 Urban Dr.
Cleveland OH

In the Ham Tradition

Many amateurs have written me obsessed with the fact that the ½ wavelength 80 meter vertical is not a perfect match to 50Ω coax.

Some have suggested the antenna be increased to ¾λ – they failed to read that if the length is increased above 5/8λ, the major radiation lobe decreases in power.

Others have suggested all types of loading coils and matching devices, all introducing reactance to the line – they fail to realize they must readjust their devices every 20 KC on the 80 meter band to keep their magical 50Ω match.

While many have actually "lectured" me, and others merely "suggested" – NONE have made the antenna and tried it!

In keeping with 73's policy of simple, easy-to-construct articles, my article describes a workable 80 meter ½λ vertical that really bounces those S-meters.

After 599, what else is there?

Roland L. Guard, Jr. K4EPI
750 Lily Flagg Road
Huntsville AL 35802

Eureka

Wow! I certainly got an S9 response from my *"New Approach to Metal Locator"*. Most of the writers want to know what can be detected – can you differentiate between tin cans and gold nuggets? . . . etc.

There did seem to be a problem some other magazine. The March 1970 cover "Not-Too-Technical Manual" was a "CLASSIC" . . . compare 66, 67, 68, 69 and part of 70 with your latest ten or twelve issues. Wayne, they're not the same. Hell, your index list used to be a riot.

Hey, this ain't criticism. Amateur Radio obvioulsy needed a magazine dealing with FM exclusively. I guess it's the coming thing.

I never did subscribe to CQ – used to buy it once in a while to take to the john at bus terminals, etc. I keep up my subscription to QST just to keep my League membership alive. And, after the first four issues of Ham Radio, I never even bothered to take them out of their mailing cover. I just let the subscription run out.

If 73 is still the same in 18 months as it is now, I won't renew – not malice – there's just nothing in it (like with Ham Radio) that interests me.

After our talk – some 6 or 7 months ago – I tried to – in fact – I did write three or four articles to submit to you, but I couldn't honestly believe that they'd fit into your new editorial theme. I even tried getting interested in FM so that I could write something funny in and on it – no luck.

It was rather easy to write for 73 when it was a 'fun' magazine. I think that a humorous piece – especially my weird humor would be totally out of place in your new concept and I can't write in and around that new concept.

I've kept my hand in though, I've written and sold a couple of good pieces, but I can't seem to come up with a formula for the new 73. It would be like submitting sections of "Tropic of Capricorn" to the Ladies' Home Journal.

Anyway, that's the explanation. Now, the question . . .

I've tried to keep abreast of magazines that go in for humor articles – even sent off to a Writers handbook to give me a list of magazines, their editors and what they wanted. Not too much available.

Thought perhaps you might have an idea or two floating around in your head. I know you keep up pretty well on all the periodicals. Just off the top

Caveat Emptor?

Price — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agencydiscount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor. . .

ELIGIBLE VETERANS build and keep a 25-inch Heath solid state color TV as part of a Bell & Howell (DeVry) home study course. GI-Bill pays 100% of the course and kits cost. Contact Bill Welsh (W6DDB), 234 S. Orchard, Burbank CA 91506

WARREN ARA 14TH HAMFEST – Still the friendliest. Sunday, Aug. 22, new site: Yankee Lake, on Ohio Rt. 7, five miles north I-80. Picnic, swimming, playground. Prizes, displays, giant free flea market. For Details & map, send card: Hamfest, Box 809, Warren, Ohio 44480.

2 METER FM I.C.E. transistor xcvr. Five xtals, mic, ac dc, FET preamp. Make cash offer or trade. WA5AAO, Box 335, La Grange TX 78945.

SELL: HEATHKIT DX-60 Xmtr $45, HR-10B Rcvr $55, HG-10 VFO $25. All very good condx. Jim Koehler, 4306 Farmcrest, Flint, Mich. 48506.

2-METER FM IC-20, solid state, mint condit, Xtals for .34/.94, .94/.94, .76/.76. Almost new. First check for $220 takes it. Bob Brunkow, 15112 S.E. 44th, Bellevue WA 98004.

WEST COAST HAMS buy their gear from Amrad Supply Inc. Send for flyer. 1025 Harrison St., Oakland CA 94607. 451-7755, area code 415.

"1971 TESTS-ANSWERS" for FCC First and Second Class License – plus – "Self-Study Ability Test." Proven! $9.95. Satisfaction guaranteed. Command, Box 26348-S, San Francisco 94126.

CANADIANS, Japanese gear, LOW, LOW prices. Free catalogue and information. Glenwood Trading Co., Dept A, 4819 Skyline Dr., North Vancouver, B.C.

NEW SIGNAL-ONE, CX-7, unopened carton, latest model, warranty – sell/trade. Want S/Line, KWM-2, Drake. Don Payne, K4ID, Box 525, Springfield, Tenn., 37172. Nites (615) 384-5643. Days (615) 384-5573.

CINCY STAG HAMFEST: The 34th Annual STAG Hamfest will be held on September 26, 1971 at Stricker's Grove, Compton Road, Mt. Healthy, Cincinnati, Ohio. Door prizes each hour, raffle, lots of food. Flea market, model aircraft flying, and contests. Identify Mr. Hamfest and win prize. $5.00 cost covers everything. For further details, contact, John Bruning – W8DSR, 6307 Fairhurst Avenue, Cincinnati, Ohio 45213.

SAVE MONEY ON PARTS AND TRANSMITTING-RECEIVING TUBES, FOREIGN-DOMESTIC. SEND 25¢ FOR GIANT CATALOG. REFUNDED FIRST ORDER. UNITED RADIO COMPANY, 56-A FERRY STREET, NEWARK, N.J. 07105.

TECH MANUALS- - - $6.50 each: R-274/FRR, TS-34A/AP, LM-21, BC-779B, BC-639A, TS-186D/UP, ARR-7, BC-348JNQ, SP-600 JX, URM-25D, OS-8C/U, CV-591A/URR, USM-26. S. Consalvo, 4905 Roanne Drive, Washington, DC 20021.

RARE – Jan. 1961 issue of 73; new conx., see page 1, Dec. 1970 issue; also eighth edition (1938) ARRL license manual; good condx. Best offer for each or both. W3WS, 707 Edgemoor Road, Wilmington, Delaware 19809.

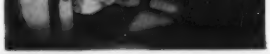
hams to send in some photos of the XYL for possible use in your monthly

with the 4.7 microfarad capacitors. Many wondered whether there connec-

of your head, do you know of any

never resumed.

NEW MEXICO HAMVENTION 1971



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S.E. 44th, Bellevue WA 98004.

for each or both. W3WS, 707 Edgemoor Road, Wilmington, Delaware 19809.

hams to send in some photos of the XYL for possible use in your monthly editions. I am enclosing three photos of my XYL, Darlene. Hope you can use them. Although she is not a ham, she is the perfect wife for a ham, hi. She climbs towers, helps me string antennas, haul equipment, etc. As you can see, she also lets me purchase fine ham gear, hi.

Received my World Atlas along with my Life Membership subscription and I think the Atlas is very nice as is the certificate.

Hope to see you on the air again.

Charles C. Thompson K4PHY/TJ1AW
Department of State
Washington DC 10521

Hope to see you both *on the air!*

Electronic Health

I was shocked to read the piece of trash entitled "Electronic Health" in the May 1971 issue. At first I hoped it would be a joke, but it wasn't. The basic problem with articles like this is that there will always be someone who feels he can do a better job of medical treatment than a physician. This would be particularly tragic with the alluded to skin cancer since better than 96% cure of some types can be obtained by such "deliberately old fashioned" methods as chemosurgery, anti-cancer drugs, and laser beams.

Skin cancer, like all cancer, is most likely to be cured if it is treated early. The person who plays with quack gadgets while his chances for cure drop to 0% has been MURDERED just as much by the persons suggesting and publishing an unsound, unproved treatment modality, as by himself.

At this point in time it is too late to unprint the article. I suggest that you publish a warning about the dangers involved and maybe even a list of cancer danger signs, so that there won't be further decreases in the number of U.S. radio amateurs.

Bruce B. Shafiroff WB2FEM/1
College of Medicine - 1971
Burlington VT 05401
University of Vermont

May issue – Electronic Health – let's have a follow-up or a few more articles of this type.

A simple construction article like the 2 meter transistor oftener would

with the 4.7 microfarad capacitors. Many wondered whether these capacitors were really that large. Perhaps we should have indicated that they were indeed 4.7 μF solid tantalums and therefore were not physically big. Incidentally, Sprague makes a diverse line of these capacitors and I tell the readers that either the 50 or 100 volt ratings have proved satisfactory. Because we are dealing with a fairly high frequency, I do not recommend other than the solid-state type of capacitor.

Irving M. Gottlieb W6HDM
931 Olive
Menlo Park CA 94025

73 Lives!!

A quick note – for information purposes and to pose a question.

I've finally gotten my ham shack sufficiently arranged, antennas erected, etc., so that I am becoming more and more active on the bands. As I meet more and more of the 'old gang' the inevitable question arises, "How come we don't see you in 73 no more?"

My appearance at a local Allied Radio Shack created an ego inflating stir of giggles and pure belly laughs and, of course, I have been receiving numerous letters asking if I am still writing and, if so, where am I being published.

Although it's impossible for me to coherently explain to you why I haven't contributed anything to you I'll do the best I can.

73 Magazine has undergone a radical change in the past year or so. It's no longer the 'different' magazine – except for the 'letters' column I haven't found a funny line or a cartoon in 73 for a donkey's age.

73 used to be a vibrant, radical even nutty magazine – a break from the monotony of QST and CQ. As it stands now, QST deals with League crap, discount CQ 'cause it's nowhere, Ham Radio is good only if you intend to spend your entire waking hours building useless and semi-useless electronic items that you can buy for half the price at your neighborhood Woolworths.

73 is now the FM magazine. The spontaniety is gone.

For example, your cover used to be worth waiting for, i.e. the takeoffs on

of your head, do you know of any that would be interested in my type of humor? Appreciate any advice – really!

Robert A. Manning K1YSD
915 Washington Rd.
P.O. Box 66
West Rye NH 02891

Though it may irritate the Ham Radio readers among our subscribers, I think that you can expect a return to the less reverent days of 73. Please let me have first refusal on your wacky stories. . . . *Wayne*

Rotten Apples

I saw a few words from my last note to you in the latest issue of 73. I realize that it was handwritten and I never got above a C in penmanship, but you really would make my ancestors create underground waves. Firstly, I have been enjoying FM since 73 turned me on to it (I just got my touchtone pad working today); Secondly, my last name is Falkof – not 'Falhof,'; and Thirdly, and most important, my call is K1NUN, not RVR. Incidentally, I was elected as president of the MIddlesex ARC recently.

Also, Wayne, an important matter arose recently on 40 meters that I need to know a set of procedure: I was handling some traffic in the form of phone patches from a maritime mobile that was limping back to port on one boiler after the other one failed in mid-Atlantic. There was less than the usual amount of QRM until a group of high power addicts moved in 1.5 kc up. This would have been fine, except that the ringleader (explanation below) would not acknowledge myself breaking, nor the /mm. When finally they did recognize us, the leader said, "We're not acknowledging any breakers unless we ask for them so all of you out there, save your breath." I then explained that I and a station in Maine were handling traffic from a disabled ship at sea and was told that they were on that frequency all night and we could take our traffic and shove it.

Being somewhat reasonable, I asked if, instead of QSYing, they could reduce power. The leader commented to his friends, "Blowing more front ends." Needless to say, contact was

never resumed.

Now I know a lot has been written about this type of conduct, and like the weather, no one does anything about it. I would like to write to the FCC to enter a complaint about these five people. I have contacted the ship's operator and a request to contact the ship's captain (who was present while several patches were run, several for him) and I am presently awaiting their word and advice. I wonder what can be done, and what should be done. I personally consider disabled ship's traffic more of a priority than signal reports from Montana to Venezuela. I am willing to submit my log to the FCC as evidence of times and frequencies and call letters and comments. Your comments, advice, etc. are welcome.

Looking forward to an answer in letter or print. I don't mind a little unintentional QRM, but to deliberately continue to interfere is, well, too much has been said.

Eric E. Falkof K1NUN
41 Prentice Rd.
Newton MA 02159

Eric, how about passing along the calls involved so I can ask for an explanation? I am sure that our readers will be fascinated to hear the rationalizations for jamming distress traffic.

. . . *Wayne*

Gene Nell (WA4IPZ) has been in a body cast for the past 15 months due to a severe motorcycle accident.

Gene put his Heathkit 2 kW PEP AMP together while lying flat on his back! (And it works, too!)

Ron Watkins K4ZZO
Delta Radio Club, Inc.
P.O. Box 16343
Memphis TN 38116

NEW MEXICO HAMVENTION 1971 will be presented 17, 18 and 19 Sept. 71, at Sheraton Motor Hotel, Albuquerque. Technical Sessions, Top Speakers, Ladies Program, Entertainment and Swapfest. Banquet on 18 Sept. For Info and Registration: NEW MEXICO HAMVENTION, Inc., Box 14381, Albuquerque, New Mexico 87111.

FOR SALE – Complete 73 from 1st issue to present, all in binders, all mint, to highest bidder. Samuels, WA2NDJ * 76-13 251st Street, Bellerose, New York 11426.

HOOSIER ELECTRONICS Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Authorized dealers for Drake, Hy-Gain, Regency, Ten-Tec, Galaxy, and Shure. All equipment new and fully guaranteed. Write today for our low quote and try our personal friendly Hoosier service. Hoosier Electronics, Dept. D, R.R. 25, Box 403, Terre Haute, Indiana 47802.

INTEGRATED CIRCUITS AND COMPONENTS. Brand new and 100% guaranteed. TTL-DIP: SN7475 – $1.50, SN7490 – $1.75, SN7441A – $2.50. OP-AMPS, TO-5: 709 – 80¢ 711 – 85¢, 741 – $1.40. Free specs. 1 watt – 5% resistor assortment (color-coded), 50/$1. 500$\mu$F-50WVDC electrolytics, 5/$2. Postage please. Catalog 10¢. Electronic Systems, PO Box 206, New Egypt, NJ 08533.

LEEDS & NORTHRUP K2 potentiometer $40. Collins antenna coupler CU1189/T, 225–400 MC. Includes SWR & power meter, $10. Charlantini, Box 222, Lexington, Mass. 02173.

EXCITING LISTENING! Police – Fire – Emergency Calls on your broadcast radio, $19.95 up. Also crystals, receivers, scanners, dual/band. Salch Company, Woodsboro 5, Texas 78393.

THE NOVICE newsletter, articles geared to Novices, DX, traffic, Novice net activities, construction projects, more. $3, year. (monthly) Sample, stamp. 1240 21st St., Hermosa Beach, Calif. 90254.

DXpedition To The Laccadives

by Venkat VU2KV

Every time I go to London I try to see G3BXI so that I can talk with my good friend Dusty W8CQ, who runs the RTTY Journal. Last February I got there just when Jim was signing off with Dusty. I had never dreamt of the Laccadives before and Russ W8DAW, who was also on the net, asked why I did not try to make a visit. Ralph W8PHZ also came on and said the same thing. After the Don Miller story, I did not want to say anything except that I would try and do what I could.

After I got back to India I started to make discreet inquiries about the Laccadive Islands, the climatic conditions there, and the problems of getting permission to operate an amateur radio station. Since my job involves dealing with the government I know how to go about things to get a successful outcome; so I did not put in an application and get a fat NO – that would have been the end of the story. In every country there are places which are restricted for people for one reason or another; and the Laccadives happen to be in this category where the government is forced to restrict entry.

While I was trying to come to grips with the problem, along came Larry K2IXP saying that he was going to the Laccadives. We all knew that at that time it would not have been possible even for Indians to enter without justifiable reason – much less Larry. Larry tried to see everyone at all levels and tried to use his high-level influence, which only made things more difficult for others to get permission. The officials seemed to be fed up with being chased.

It was long after Larry had left that things were ripe enough to put in a formal application for operation from the Laccadives. I asked Rao VU2RM and Hegde VU2DI to come along. Both had been to the Andamans before. They both agreed to take care of their own personal traveling expenses, and I undertook to take care of all the rest. We thought that if people sent us a few extra IRCs we could reasonably hope to recover some of the expenses. Having sorted the composition of the team, the

question was to get sufficient reliable equipment. Having operated a multi-multi station from VU2IRA during the CQ contest, I decided that we should operate in this fashion to take advantage of band openings and also to make more contacts. To do this we needed a lot of equipment. I had the Heathkit HX20 transmitter, the FL1000 amplifier, the Collins 51J4 receiver, and a TA33JR. I got hold of a Swan 500 from VU2DGM and quickly built up a separate vfo for split-frequency operation. I borrowed an FTDX 100 from VU2REG. He did not want to be QRT so we had to get him an FLDX 400 from VU2IRA. Jinny wanted to keep her daily skeds with K6OE so we fixed up a spare HW32 from VU2BEC for her. I also borrowed a 14AVQ from VU2REG/BEO. VU2OMR had a tape dipole and that, with the Heathkit DX40 and SX96, formed the fourth station.

While we were doing all this no one knew about the DXpedition. I was quite regular on the band and everyone was asking about the other expedition which was supposed to go there. Because of the preliminary spadework, the permission came through quickly. There was a hitch about the red tape involved in getting the entry permits, but fortunately the administrator of the Islands who was visiting New Delhi straightened everything out. We were content with the inadequate publicity we'd had thus far, as we did not want to be the cause of idle rumors. We managed to get in print on the Geoff Watts DX Bulletin before the postal strike grounded him and the Gus Browning's DX newssheet before we got to the island. I was also lucky to have QSOs with the DX editors of several clubs during the week before we left, and this also helped to spread the news. The special permission to use the VU5 prefix came very late, so many people were in the dark about the call sign we would be using till they heard us on the air.

Once everything was clear I had to arrange for proper packing of all the gear. I had to plan the packing to insure that each case contained a complete station, and loss or damage to one would still keep us on the air. Packing also meant figuring out the food and probable medical requirements for 20 days, etc. We were aware that nothing was available on the island except fish and coconuts. I also had to take some steel poles for masts because there was nothing suitable on the island. Radha, my wife, also decided to come along just for the fun of it and to insure that in trying to work DX we did not forget to eat. She came prepared with a lot of painting equipment to keep herself busy with the local scenery.

Laccadives is a really DX location for us in New Delhi. It is about 2000 miles away to the south in the Arabian Sea off the west coast of India. There are 20 islands in the "Laccadive, Amindivi, and Minicoy" group, of which only 10 are inhabited. They are all primitive fisherfolk living in these islands who depend on fish and coconuts for their livelihood. The island we went to is Kavaratti, the administrative headquarters for the group.

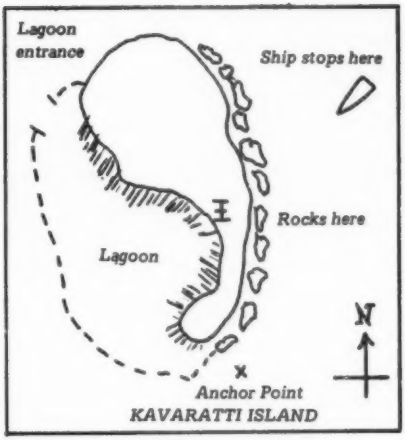
We had to play safe in planning to make sure that there was no last-minute slip. The entire baggage weighed over a half ton, so we had to travel by rail. Because of the long distances involved, we allowed a spare day at each point to avoid missing connections. We left New Delhi for the 1300-mile rail journey to Madras (42 hours). At Madras, Rao joined us. After being entertained by the local hams, we left the next day for the port of Cochin, 500 miles southwest of Madras. We got to Cochin two days

later and were assured that the ship would leave the next afternoon. We were told to get our heavy baggage booked early to avoid delay. It turned out that VU2TH's father worked for the shipping company and that made sure of VIP treatment for the baggage. The extra time we had in Cochin allowed us to pick up fresh vegetables which we would not get in the island.

The shipping service must be highly uneconomical for the company to operate on a reasonable fare structure. To minimize losses they avoid all unnecessary expenses like berthing at the jetty, and instead lay up in mid-channel. The passengers and cargo have to go by small boats to mid-channel and get on the ship there. The captain's 13-year-old son who had come to see his father off was at the winch controls, and for a moment we thought that the antenna package was going to be at the bottom of the shipping channel at Cochin for some underwater DXer. But luck was with us and the boy brought the package through.

Due to radar trouble we set out from Cochin late in the evening and reached Kavaratti island at midday instead of daybreak as planned.

Operation disembark was the trickiest maneuver and can be best described with the help of the sketch of the island and the lagoon. The island has a coral reef forming a lagoon on the western side and the entrance to the lagoon is on the northern end. The ship cannot approach the eastern side of the island because of the steep shelf with large rock outcroppings. The only place where the sea is not too deep for anchoring is near the south tip where it is 200 fathoms deep. Otherwise the sea is about 1000 fathoms within approachable distance. Because there was a lot of cargo to unload, the captain decided to get the



Sand beach on lagoon side, rocks on eastern side. Approximate location of VU5KV shown ⧗

ship as close to the lagoon entrance as possible under the conditions. The ship hove to on the leeward side of the island, for there was a moderate breeze blowing from 330 degrees.

We disembarked into a small powered boat on the leeward side of the big ship. Though the waves did not appear large from the deck of the ship, this was tricky and had to be done quickly, as both the ship and the boat were continuously being tossed around. One moment the boat was close to the ship and the next moment it was several feet away. After we had managed to jump into the small boat, things became tougher as the boat was being really tossed hard against the side of the ship and the ladder was being squashed flat.

Having become unsafe, the ladder was retracted and the rest of the passengers had to come down a rope ladder dropped over the ship's side. We were lucky that we did not have to do that. We did not particularly fancy going down a rope ladder with the sea 1000 fathoms deep when we could not be sure of the boat being at the

bottom when we reached there! Also we were lucky that the sea was not really rough as in the monsoon season, when they handle passengers like cargo and lower them into the boat in a rope sling with the ship's winch!

The journey to the lagoon entrance, which was against the breeze, was a slow process as the boat at best of times could not do better than 4 knots. It was not a pleasant journey and we could not take any pictures as every wave sent a huge splash into the boat and we were all completely drenched in the process. The roughest part was the approach to the lagoon entrance. The waves had a complex pattern here and the small boat was really tossed in all directions.

The green color of the lagoon was in sharp contrast to the deep ultramarine blue of the deep sea beyond, and this made a beautiful picture. Navigating through the lagoon was slow as it is very shallow and one could wade through parts of it. After about two hours in the small boat we had our feet firmly on the hot sand.

The island was full of sand all over, and coconut trees provided the only vegetation. It was very cool in the shade but the sand was a furnace. At high tide, the island is 3 miles long, ¾ mile wide at the widest point and only about 50 ft at the narrowest point.

We recovered from the journey after we had filled ourselves with coconut milk. Then we set out on the island's public transport which consists of a tractor with a trailer for the passengers and their baggage. The only other vehicle there is the administrator's jeep. After lunch, we surveyed the scene for possible antenna locations. The place that was allocated to us was too densely overgrown with coconut trees and had the local telegraph wireless station next door working near 7 MHz; so we decided to go to the open space near the police station where they had already cleared some of the trees for their antennas.

The baggage took time to get unloaded and didn't arrive until evening. It was getting dark and we had to act quickly to get on the air the same day. The FTDX 100 was taken out first, and the 14AVQ was fixed on a short piece of pipe driven into the sand.

With so little man-made noise the band was alive with plenty of signals. We made the first contact with VU2BEO at 6:52 p.m., one hour and 22 minutes behind schedule. Then we went off to 14195 kHz and the whole band above 14250 was calling us within ten minutes.

VU2KV sitting, VU2DI standing, white shirt, VU2RM, standing, colored shirt.

We let Rao get familiar with the controls and operate the rig while we unpacked the gear and set everything up. Because of the good packing, nothing was even scratched and we were able to get the linear into operation by about 8 p.m.

It was surprising how much DX we managed to work with 50W dc input into the 14AVQ. We could only work one rig that night as only one antenna

was available, but we used the time to set up and check all the rigs. Hegde unforunately got grounded with tummy trouble and he was marched off to bed after the doctor had given him medicine.

Only after the band showed signs of packing up the next morning were we able to switch off for a while and get the antennas organized. The 14AVQ was repositioned on top of a 20 ft tower and the TA33 was put up. The Mosley vertical was tied up on a flagpole. We had to wait till we could locate a local villager to come to get the tape dipole across two 50 ft coconut trees. With the antennas up we were able to operate two bands at the same time and during the day we were on 15 and 10 meters. As 10 meters went down we would change to 20. We had two rigs on the air practically all the time and three when Hegde was feeling better. Meals had to be staggered to keep the station going.

QRM was tough at all times and the pileups were unprecedented. From the first day onwards, the entire band from 14250 to 14300 was just one wide band of noise. We were later forced to spread the boys across the entire band from 14200 up. Most of the time we never worked anyone on the last worked frequency, and this helped to keep the pileup spread out. The boys seem to have found out how we were changing our listening frequencies, and after the first couple of days the boys were still congregating at some pet spots. So we changed our tactics and kept the boys guessing where we were listening. I guess this gave a chance to the good operators who did not necessarily have high-powered rigs but knew what good operating practice was. We are ourselves surprised how we managed to work three or four stations a minute at peak conditions when QRM was also at the peak.

After excellent conditions for five days the next two days had very poor conditions. On many occasions, though we were putting a good signal into the west coast of the states, there were not takers and we had to get some boys from bed to give us contacts!

Operating from the island had its peculiar problems. The power station had a 36 kW diesel generator. There are no streets in the sand but the paths have lights, and this load is about 40 kW. The line voltage was bad and the regulation hopeless. We were prepared for this contingency and had taken a 15 kVA line voltage adjuster. Even with this the maximum that we were able to boost the line voltage at night was to 210 which would go down to 185 on a whistle. We thought of bucking the line voltage to 110 so that we could use the autotransformer to bring it back to 220 but this meant switching off the mains to change over from day to night, so we decided against it.

At night we had the rigs QRP or work staggered so as not to drop the voltage too low.

We were told that the ship would be sailing for the mainland on January 27th via Amini island. We had no choice but to leave, as the date of the next voyage was indefinite and uncertain. They forced us to get the heavy baggage loaded on the ship on the afternoon of the 26th as the tide was otherwise unfavorable. The low tide the next morning would not permit the heavy boat to get out of the lagoon and they did not want us to hold up the ship while we got our delicate cargo loaded.

We had a great time at the island. We were not too happy at the prospect of

getting the rigs away a day in advance, so we repacked all the stuff and retained the FTDX-100 and the 14AVQ which we could carry in the suitcase with us and the clothes were sent off to the ship. With only one rig available on the 26th we had free time on hand and gave a talk to the local high school on amateur radio. That brought a lot of QRM in the shack that evening.

So we finally bade goodbye to Kavaratti island after having been there for 185 hours from the 19th to the 27th of January and having made 6327 contacts. The sea was very calm and boarding the ship easy. We sailed for Amini island 35 miles northwest of Kavaratti and the ship was anchored outside there for the whole day. We had plans to go ashore and take the FTDX-100 and the 14AVQ and get on the air, but changed our minds at the last moment. Although generally known as the Laccadives, Amini is part of the Amindivi group and we did not want to mar the successsful expedition by operating from there, which could have been questioned. Only Rao ventured to go to the island and came back satisfied after having tasted the local coconuts!

The return journey from Cochin back home was uneventful as we had become very experienced in traveling with luggage in ton lots. Things were even more smooth sailing with the help of VU2MO who helped with train reservations and in insuring VIP treatment for the luggage.

The real part of the DXpedition started when I got back. Little did it occur to me that while it may be possible to make three or four contacts per minute, it is certainly not possible to fill out QSL cards at that rate! When we dropped into the office, I had to get a large sack to cart the mail home. I was on vacation for another week, and that gave me time to catch up with the printers and make sure we had the cards here early and be in a position to tackle the pile soon.

I had a desire to finish the QSL business soon, and if possible within one month of the expedition. So I sat at the dining table till 2 a.m. every day and got the QSLs all answered. We had to make other arrangements for eating, but I was able to get all the cards replied within the target date. Having answered all the cards, I can sit back and take it easy answering the 25–30 cards that are still coming in daily. I only check the cards against the logs and fill them out and thereafter it has been taken care of by the XYL and the two girls aged 8 and 12. They know what the postage rates are, where the addresses are, and all the different commemorative stamps that are available and how to get them. I am sure they will be good QSL managers.

Everything went fine with the DXpedition and we were most happy that nothing went wrong. Murphy did not show up at all and this surprised us a great deal. We realized we were wrong when the film came back from the processors as a blank piece with nothing on it. Closer examination revealed that the camera shutter was stuck shut and all the films were not exposed. The only record of the island that survived are in the pictures Hegde took and the 8 mm color film and this will explain the reason for the few pictures here. We have no way of reproducing the beautiful landscape from the XYL's paintings. At least one lesson has been learned: Checking the rigs is not adequate – *everything* has to be checked before a DXpedition!

. . .VU2KV■

Bob Dean,
Alden Electronic & Impulse
Recording Equipment Co., Inc.

Facsimile for the Radio Amateur Part 1

Many people have been looking into the field of facsimile communications only to find that while it is potentially useful for the radio amateur, there isn't enough literature available dealing with the basics. However, with the data contained herein, the amateur will have the fundamentals with which to explore and conduct facsimile experiments. For instance, you might be interested in direct communications with another ham utilizing facsimile. This method of transmission may be used for practically any type of copy, printed, written, drawn or photographed. Of course while fax will never replace RTTY or voice transmission for traffic handling, the advantages are obvious. For example, remember the last time you tried to explain a complex circuit change over the air? Imagine how easy it would have been if you both had the same schematic. Certainly the U.S. Weather Bureau and Wirephoto services are convinced of its value. Both of these services make continuous use of the facsimile devices for transmitting weather maps and news photos by landline and radio. Since the amount of equipment required to monitor facsimile radio circuits is minimal, it's fairly easy and inexpensive for hams to begin experimenting in this area.

After his first experience with facsimile, the experimenter may be interested in copying APT pictures. These are cloud-cover images received directly from orbiting weather satellites. These cloud-cover photos are used as a forecasting aid. They enable the meteorologists to keep a close watch on uninhabited areas for early detection of potentially dangerous storms.

Hams currently experimenting with slow-scan TV might be interested in knowing that the U. S. Weather Bureau is successfully using ALDEN facsimile recorders as the readout for instantaneous radar weather data. A TV camera operating at 8 scans per second continuously scans a weather radar scope. When connected to an ALDEN remote radar facsimile recorder, highly detailed copy of the radar PPI presentation is produced. Thus, with certain adaptations, the ham that's already experimenting with SSTV might find the facsimile recorder ideal for use as his readout.

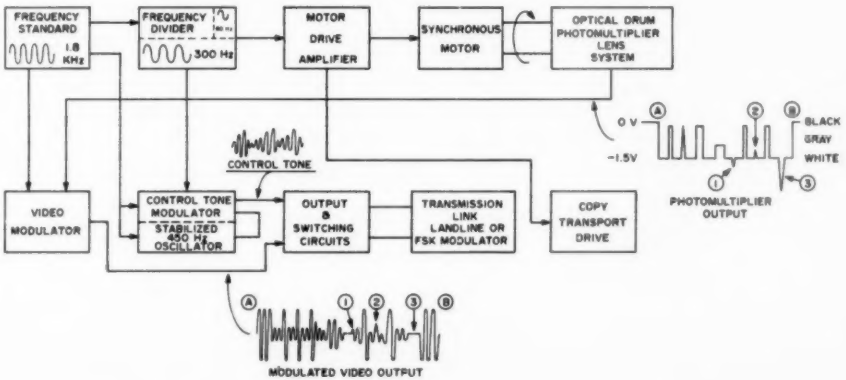
Other uses for the facsimile recorder are

quite varied. For instance, the recording technique is often used as the graphic display for a sonar. A similar device has been attached to a spectrum analyzer and used to provide a graphic record of its output; while still another was used to copy the output of a scanning electron microscope. So you see, even while facsimile's primary use lies in the field of communications it may successfully be adapted to display data from many other sources as well.

Facsimile Operation

Items for transmission are all two-dimensional because the facsimile transmitter is a fixed-focus device with a limited depth of field. There are two widely used methods of sampling the image density of the copy. In one method, the copy is clamped onto a drum facing outwards. The drum revolves at a precisely controlled speed. Light is focused onto the copy in such a manner that the reflected light will be captured by a lens system and passed through an aperture into the photocell. As the drum makes a complete revolution, the photocell samples the intensity of the reflected light for a narrow segment of the copy. As the drum rotates, it also moves longitudinally. In this manner, the image density is sampled one line at a time with the scan beginning on one side of the copy and proceeding completely across it. The second line begins directly beneath the first. The output of the photocell is used to modulate a carrier (usually 2.4 kHz). This may be placed directly on a landline or used as the input of a frequency-shift keyer for transmission using standard sideband equipment.

In the second method copy is fed into the paper feed transport situated above the light table. Reflected light is projected through a lens system forming an image on the straight aperture. An optical glass drum rotates with a transparent helical line scribed in its opaque surface. The intersection of this helical line and the straight aperture forms a flying-spot aperture to scan the image line by line. The light which passes through the aperture is focused onto a photomultiplier which converts the light into an analog electrical signal. The output of the photomultiplier, as in the first unit, is used to modulate a carrier for use on landlines or for use in driving a frequency shift keyer. There are distinct advantages to the second method, such as being able to vary the definition by changing the number of lines scanned per inch of copy. Also, by use of several turret-mounted lenses, optical enlargements of copy can be accomplished. Finally, nearly any thickness copy may be transmitted ranging from onion skin through cardboard. This is not possible on most drum-type transmitters as the copy



wouldn't be in focus.

Included in the fax system block diagram (Fig. 1) is a frequency standard. Normally this will be either a tuning fork or an extremely stable crystal oscillator. The facsimile systems in use throughout the world contain internal standards in both the transmitters and recorders, and all are ultimately referenced to the primary standards. By use of these internal standards the necessity of transmitting a synchronizing pulse along with the video data is eliminated.

One of the major benefits of using all internal standards is that if the signal should be lost for a time due to fade or excessive noise, only the portion of the image scanned during that period is affected. Hence, a recognizable image may often be obtained by way of facsimile when even CW has a hard time coming through. In fact, during severe fade and poor propagation conditions, fax has been used to pass traffic when no other means would work.

As far as the remainder of the block diagram in Fig. 1 is concerned, the primary function is to generate a highly stable 60 Hz output of sufficient amplitude to drive the synchronous motor which precisely controls the rotation of the optical drum. The photomultiplier output is used to modulate the carrier normally 1.8 or 2.4 kHz. The modulated video output or the output of the control tone modulator is then selected and switched to the transmission link.

Two of the wave forms accompanying Fig. 1 depict the output of the photomultiplier and the modulated video. From point A to point B represents one scan line of typical copy. You may note the irregularities numbered 1–3, which are shown primarily to explain the effects you will note on recorded copy. For instance, number 1 shows up as a distinct lack of background noise from the photomultiplier. This is due to an excess of light at that point on the scan, usually caused by a pinhole in the opaque coating in the optics; it is referred to as an "opening." It will show up by eliminating small signal elements of regular copy that occur at that point on the scan.

Number 2 is just the opposite. Here we have a repetitious pulse above the background noise of the photomultiplier. The cause is normally due to dust on the line of the drum or the aperture plate. In this manner, light is partially blocked off at that point in every scan; hence, a straight vertical line will appear in the recorded copy. This is called a "closure."

Number 3 is referred to as the "optical off-time." Here a superwhite pulse is transmitted due to the intentional coincidence of the line on both ends of the drum with the aperture line. Again, this admits an excess of light and in this case negates signal elements that occur during this portion of the scan.

Basic Transmission

Prior to the transmission of an image it is necessary to start the recorder at the reception point and center the image. Depending on the service copied, the sequence of transmission of various control signals will vary. At present, facsimile traffic utilizes a specific sequence of events before and after image transmission.

Weather maps and amateur facsimile transmissions will usually follow the sequence which is depicted in Table I.

Table I. Sequence of Tones, ALDEN Facsimile Recorder

5 sec	5 sec	22–25 sec	1 sec	duration of image	5 sec
240 rpm tone	start	phasing	record tone	image	stop tone

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So what do you do? Perhaps you decide to put your eggs in one basket and just advertise in the largest magazine and let it go at that. Or perhaps you figure that you'll do better to advertise in the two largest magazines and not spend the time and trouble trying to get the last dollar of sales out of your ads. If you look at the magazines you notice that some advertisers run ads in all four magazines and ignore problems such as overlap of readership, grossly exaggerated circulation claims, and unfortunately large numbers of non-buying readers.

The prospect of running comparison ads in all the magazines just to try and find out which really does sell the best is frightening . . . and expensive. And then you have to get someone to sit down and count up the dollar volume of sales that the various ads brought in and equate that to the cost of the ads. No wonder so many advertisers just give up and throw the dice to decide their ad placement.

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1/16 page (1")	35	32	28

Table II. Functions for Fax Tones

FREQUENCY	FUNCTION
852 Hz	Selects 240 rpm drum speed in automatic recorders when transmitted prior to the start tone.
675 Hz	Selects 48 lpi paper feed rate, starts recorder – recorder will run at 120 rpm unless preceded by 852 Hz in which case operating speed will be 240 rpm at 48 lpi.
450 Hz	Stops recorder.
300 Hz	Selects 96 lpi paper feed rate, starts recorder. Recorder will run at 120 rpm unless preceded by 852 Hz in which case operating speed will be 240 rpm at 96 lpi.
60 Hz	Record tone. Enables paper feed and printing mechanism in some recorders.

During the starting sequence, if the first tone transmitted is 852 Hz, the transmission will be made at a speed of 240 rpm. This is primarily in use on landline circuits. The start tone normally transmitted is 300 Hz. This tone will start most of the recorders which are designed to function automatically. Where receipt of a certain tone selects the paper feed rate, the 300 Hz tone corresponds to 96 lpi. Where the recorder is also capable of automatic drum speed selection, 300 Hz (not preceded by 852 Hz) will initiate recording at 120 rpm. If the start tone should be 675 Hz, this will select 48 lpi resolution at 120 rpm (unless preceded by 852 Hz). Table II is provided as a reference for tone functions.

The next occurrence is the phasing signal (also referred to as the framing bar and/or sync pulse). This is used to center the recording, by insuring the drums of the transmitter and recorder start the scan line at the same instant. The phasing signal is normally solid carrier for 95% of a scan line and a complete collapse for a 5% segment. (The "optical off-time" should be in coincidence with the 5% collapse of carrier.) The duration of the phasing signal is usually 25 seconds.

After the phasing, a 1-sec burst of 60 Hz modulation is transmitted to start certain recorders which have already been framed. This is used in recorders such as the AN/UXH-2. Finally, the video signal (or image data) is transmitted. Normally, a weather map of average size requires about 10 minutes to be completely scanned. After the image is transmitted a stop tone of 450 Hz modulation is sent to shut down the recorder.

Wirephoto Transmissions

Since this service is more or less confidential in nature, the radio broadcast frequencies and transmission times are probably not divulged except to those paying for the service and the FCC. However, it is possible that a ham will eventually locate a working Wirephoto channel. The system of transmission is similar to weather facsimile but I do not believe it is intended to operate completely automatically. The transmission sequence is as follows:

At the beginning of each picture, there are a series of black-to-white transitions varying in number from 3 to about 15. The last white transition which may be preceded by a code line, usually has a duration of approximately 40 sec and is immediately followed by approximately 1 minute of phasing signals. The picture follows immediately. All of the Wirephotos I've copied have been at a speed of 60 rpm; thus, no control tones to change the operating speed would be necessary.

Satellite Transmissions

There are several weather satellites currently in operation and while their transmissions differ slightly, the APT image is a constant. Each frame requires a total of 208 sec to transmit. This figure includes 3 sec of 300 Hz modulation, 5 sec of framing signal and 200 sec (800 scan lines) of image data. (Since most APT recorders start and run upon receipt of the 2.4 kHz carrier the 300 Hz serves only to initiate the framing sequence.)

Radio Sources

Signals are applied to the user in various

EXPERIMENTING IN FACSIMILE?

The leading manufacturer of 18" facsimile weather chart recorders is in the process of converting an existing network for fully automated weather chart transmission. This conversion will make available a number of used 18" weather map recorders ideally suited for use by anyone interested in experimenting with facsimile.

They include the recording head, all necessary electronics including automatic start, phase and stop circuits. Operating at speeds of 60, 90 or 120 rpm (depending on model), these recorders, with suitable receiver and FSK converter, can be used to monitor radio weather chart broadcasts from stations located around the world or modified to accept press wire pho'o transmissions or modified to receive transmissions from orbiting weather satellites.

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ways. The U. S. Weather Bureau, U. S. Navy and Wirephoto services operate extensive landline networks around the country. However, the Weather Bureau and Navy also transmit weather data for use by the ships at sea utilizing HF sideband techniques, and over the last few years they have been experimenting with a satellite in sun synchronous orbit (known as the ATS – Applied Technology Satellite) for relaying. (The ATS operates at 135.6 MHz.) Both weather maps and Wirephotos are transmitted over HF signal paths. The bulk of the signals heard will be FSK. Naturally, this reduces the problems with noise and fading. An 800 Hz shift is generally utilized and the normal frequency limits are 1500 Hz which usually corresponds to black and 2300 Hz which is normally transmitted for white. Gray shades should produce signals which vary linearly from 15 to 2300 Hz with respect to the density of the copy.

Tuning a receiver for facsimile is nearly the same as RTTY. In this case, however, if the bfo happens to be reversed and the correct input limits are obtained you will get an image which is a negative of the original instead of a lot of garble.

The satellites, on the other hand, transmit over a line-of-sight VHF path using 10 kHz deviation FM. In this case we have a very low-noise path due to the use of FM equipment. Thus, the signals from the satellites are strictly 2400 Hz modulation.

To receive these pictures in your shack, you need some type of fax recorder. You could fabricate your own, but I advise against it unless you are a machinist as well as an electronics experimenter. In any event, there is a wide variety of surplus recorders available from military as well as commercial sources. While some modifications and repairs may be necessary you'd come out ahead in the long run.

Next to copy weather maps and Wirephotos you must have some sort of general coverage receiver, which is stable, reasonably sensitive and selective and has the capability for copying sideband. The next part of this article will cover that subject in depth. ■

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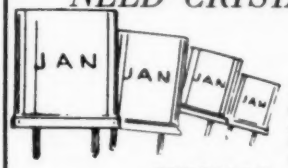

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YOU CAN TAKE IT WITH YOU!

The fastest growing pastime in America during the past several years has been camping. Families, literally by the millions, have been drawn out of their comfortable homes into the not-so-wild outdoors.

It stands to reason that several thousand of these campers are also hams. It is also well known that many persons believe that hobbies, like certain ingestible liquids, are better when mixed. But mixing ham radio and camping has not been the easiest thing in the world.

Certain problems have made hamming while camping less than simple. In the days when most camping was done in tents and most hamming was done with rack and panel rigs of monstrous proportions, the two just didn't mix. But things are different now in both hobbies. More and more campers are consigning their tents to the attic or basement. They are venturing forth into the bosom of Nature in campers, trailers, motor homes, and the like. At the same time ham gear has become smaller and more genuinely portable. The state of the art in both fields now brings hamming and camping much closer together. Most of the current crop of recreational vehicles lend themselves to the inclusion of radio gear about as well as the average fixed station. A rig like any of the myriad of transceivers on today's market can be included without having to leave something else home.

Certain other problems besides space remain to be worked out, but most of them will likewise yield to some degree of determination, with very little sacrifice either in room or operating efficiency.

The first and most obvious handicap to be dealt with is an adequate source of power. This was a serious matter when tents were the order of the day. About the only answer then was the already overworked electrical system of the auto itself. This system can handle the added load of ham equipment while the rig is in motion but it is not made to be used in semifixed mode. But this is not much of a problem any more. Almost every type of recreation vehicle (rv) in common use today is wired for ac. All that is necessary now is to pull up to the camping site (after paying the usually very nominal fee) and attach your extension cord to the provided outlet. Very few places will even charge above the minimum when you show them that your equipment is not heavy-current gear.

Most of the camping grounds in America today, both public and privately owned, have installed ac outlets which have reasonably stable sources of power. Very few rv's have breakers or fusestats smaller than 15A, so you are in business!

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A somewhat more difficult problem to overcome is the matter of an adequate antenna system. All sorts of systems have been used by enterprising hams but most of them have drawbacks which militate against their use. Some are simple enough to get up but leave a good deal to be desired performance-wise. Others work well but unless you plan to be in one place for several days, it simply is not worthwhile to erect them. The crowded campground presents something of a limitation, too.

But again this problem can be overcome with a system that is both easy to erect and of reasonable efficiency. Over some period

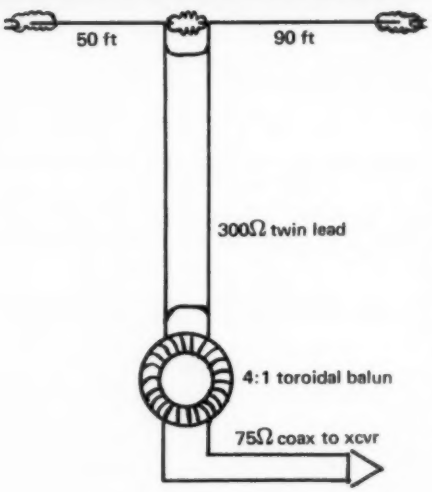


Fig. 1. Sketch of antenna.

of time the author has worked out a system which seems to achieve all that might be asked of such an antenna system. It has been refined during a number of excursions in several parts of the country.

The antenna itself is a 140 ft wire cut in the not unfamiliar mode of the time-honored Windom. This type was chosen for a variety of reasons. First it is multiband, operating quite satisfactorily on 75/80, 40, 20, 10 meters. Second, the antenna is low in cost and easy to construct and takes no special tuning. Third, it is lightweight and can be supported without difficulty by any light support. When fed with 300Ω line and through a simple toroidal balun such an antenna will give low swr on all the above-mentioned bands; and best of all, it represents no compromise on any band. It will compare quite favorably with most fixed station radiators. The details of the antenna are given in Fig. 1.

The only requirement for the erection of a simple wire antenna is a support at each end. Trees are almost universally available in campgrounds. They can easily be used when only a modicum of choice is used in site selection and a simple packet of equipment is stored with the other camping gear.

Basically the process is simplicity itself. No more than 20 minutes should be required to get the wire up and *you* need never get off the ground!

The procedure is as follows:

1. Secure a small bow of the recurved type. This is available virtually anywhere.

The one we use is four feet long and was purchased at a local discount store for less than $5.

2. Select a long arrow and cut a thin notch all around the arrow about five inches from the hackle end.

3. Attach a monofilament line from a fishing rig (the spinning type works well) to the notch.

4. Notch the arrow in the bow, position the rod so that the line will pay off freely, release the catch on the reel, aim above the limb you want the line to go over, and shoot. Practice may not be necessary, but it isn't likely to hurt.)

5. Allow the arrow to go over the selected limb and to fall to the ground below. Some discretion must be used here, obviously, in a crowded area, but we have never found this to present any major problem.

6. Retrieve the arrow and detach the line.

7. Tie a nylon line to the monofilament line. Tie it very carefully with a secure knot.

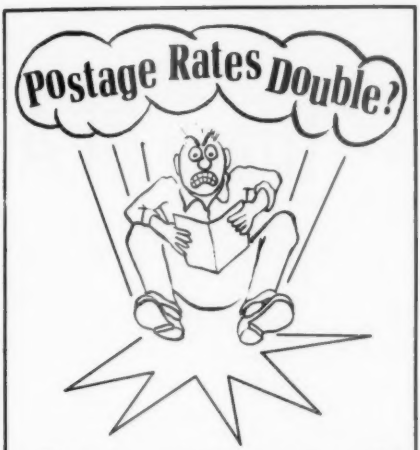
8. Reel in the line and allow it to be drawn over the limb. Bring it all the way back to you.

9. That's all! Just attach the antenna insulator to the line and hoist up one end. Repeat the process at the other end and you can be on the air with a satisfactory antenna in less time than it has taken you to read this article.

One last word of caution may be in order. You may have found that your recreation vehicle is rough riding. Most of them are. If so, either carry your rig in your car or wrap it securely with some sort of shock absorbing material if you choose to carry it in your trailer.

Such a system will allow you to get your rig installed and on the air almost anywhere, and the best part is that you will be putting out a respectable signal. So the next time the family wants to go camping and the "sweepstakes" is coming up, instead of a contest of will, try a little mixing. You may open up a whole new world of entertainment for yourself by hamming while camping.

. . . K5PAC■



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Diary Of A DXpedition

(For Those Who Can't Afford A DXpedition)

Matt Oreskovic WA2JLF ex-KD2UMP
1425 Abbott Road
Lackawanna NY 14218

Isn't it a shame that the world has lost its sense of humor. Even hobbies have to become avaricious pursuits. And isn't it a shame that life passes you by so quickly that you never get a chance to do a lot of things that you always wanted to do. I know guys who dream of operating their rigs from exotic places, basking in the sun, tossing down cool rum drinks, or checking into a net each day for a prolonged chat with friends on the airwaves until the "Big Net Control" in the sky 73's them for the last go-round. Me, I'm still chasing DX from a cold basement before and after work, fighting it out with the big boys feeding stacked beams up a wavelength, usually getting clobbered. I'll end up in Pooped Payton Place with the best of 'em tending my travel trailer and making TVI for the other trailer park tenants while running traffic north to the kids QTH. So before my SB102, SB640, SB200 get the final tag that says "from the estate of the late WA2JLF" I'd like to be an exotic station, sought after, piled on, cursed and given undeserving complimentary signal reports. I have some buddies that harbor the same dreams. "We'll probably never get to Market Reef or Swan Island." was our cry, until we got our heads together for a poor-man's DXpedition. So this is the true story of a handful of ordinary guys who had a dream come true for twenty-four hours.

It all started the fall of 1970 when a DXpedition to Swan Island occupied the DXers' time. I thought, what the heck, why not have a DXpedition of my own? I discussed it briefly with Zero (WB2ZMO) and Frank (W2RSJ). The next morning driving into town. I talked it over on 2m FM with Joe (K2DSO), an oral surgeon.

I knew of a location with an exotic-sounding name and carrying with it the required difficulties of getting permission to use the place, plus the possibility of getting a call sign that would be distinctive. The location was Squaw Island, located 42 degrees fifty-five minutes 48.5 seconds north latitude, 78 degrees 54 minutes 14.5 seconds west longitude; it lies wholly in American waters between the United States and Canada. The waters west of the island are not navigable except for small powerful craft. Joe (K2DSO) and I had KJ2UNK in mind as a call sign, but the Buffalo FCC office suggested that the call sign would confuse people because of its use on Johnson Island. KD2UMP was chosen, and we are sworn to secrecy as to the originator of the call.

All planning for the DXpedition was taking place on 2m FM, and most listeners thought it was some sort of gag. The Western New York 2m FM bunch is not adverse to pranks such as sending ARRL Official Observer cards to innocent souls for "excessive monitoring." I might add the cards were obsolete, as was the call of the "Official Observer." The counter-

Joe Margarone (K2DSO) (l.) receiving proclamation from Mayor Frank A. Sedita. This was a milestone in the legitimizing of KD2UMP.

attack for the phony cards was planning an imaginary microwave project using helical polarity from left to right – or was it right to left. Bags of opened and used food were to be found on the doorstep of WB2QDA's QTH weekly while he was out on strike. A Canadian user of our repeater, VE3ADO, offered to show me how to put an ac plug on a piece of lamp cord. I might add that he will be the subject of "massive retaliation" when he returns from VK land.

The DXpedition was not a gag, and the deeper we became involved in the project, the more believers joined the ranks. At a meeting of BARRA (Buffalo Amateur Radio Repeater Assocation) Joe (K2DSO) asked for support for the DXpedition. The response was unanimous, as was the response of the South Towns Amateur Radio Society of which I was president. I think the fact that we forgot to ask for money helped railroad the "support resolution" in both clubs. We still had to get a call assigned and a bona fide reason for the DXpedition. The request was drafted and redrafted until it stated the specifics of the desired call, and when the last and final draft was ready for typing we crossed our fingers and hoped that we could get a special call for Squaw Island.

Nearly a month went by and we passed the deadline for any big amateur magazine publicity. The call KD2UMP was finally granted for a twenty-four hour period of time for April 1, 1971, 0000 to 2400 GMT. The real work was just beginning.

I did not know a soul who had been to Squaw Island and frankly didn't know any legal way of getting to the island to do some necessary scouting. We went ahead with plans anyway. It was immediately evident that several backups for every item necessary would have to be considered. At the appointed hour we could fall back on secondary choices for antennas and rigs, not to mention operators, workers and living accommodations. We now entered the "promise" stage of planning, a time during which souls of good intent tend to promise more than they are capable of delivering. As an example, we were promised – I might add unsolicited – a telegraph pole in excess of forty feet, set in the ground, electric power, and a travel trailer. I don't remember if the "promisee" offered to furnish food and drink for both days or not. Hollow promises tend to waste a lot of time because you have to go through the ritual of calling the promisee until he finally comes to his senses and begs off from the promise.

We would need a tower to support a beam; a ladder that can extend to twenty-five or thirty feet with an eight foot mast would do nicely, and I had such a ladder. We purchased some good nylon line for guying the ladder, and the tower was in the bag. Our South Towns ARC had a beam that was left drooped over a roof after our County Fair episode. A cold winter afternoon liberated the beam and we headed to the clubhouse at a former Nike base to get a 22 amp generator to power the encampment planned for Squaw Island.

Problems began to compound; the generator had a stuck valve and a broken needle valve. Winter claimed a toll on one of the beam traps. My trailer needed some unexpected repair, another trailer had to be taken from winter storage, a

KD2UMP

SQUAW ISLAND DX-PEDITION

QSL card for DXpedition. Bottom row: Lee (WB2QDA), Ted (WA2HKS), Bob (WA2VVF). Standing: Frank (W2RSJ), Matt (WA2JLF), Zero (WB2ZMO), Joe (K2DSO).

third could be had if we could repair a faulty furnace. During this phase, three of us – W2RSJ, Frank, and WB2ZMO – were the only ones doing the physical work connected with repairs and getting the rigs we planned to take along readied. K2DSO was hopping around getting the paperwork taken care of.

Squaw Island has much trivial history attached to it. For example, it was the staging point for an invasion of Canada by a group of Irishmen around the turn of the century. The group were members of the Fenian Society; they crossed over into Canada and occupied a town near the eastern shore for a period of several hours until a contingent of Canadian Provincials routed the party of twelve or so and confiscated their rowboats. During the era of prohibition of the sale of alcoholic beverages in the U.S., smugglers used Squaw Island for a haven. Cottages and boat houses dotted the western shore. After repeal of prohibition, the cottages were taken over by squatters who just recently were forceably evicted by the authorities. So – during the night at least, the island is uninhabited save for wild dogs, wild cats, and rats.

Up to the present time the island has not had a moment of glory. It usually gets a big guffaw from those who know about it. It suffers from gigantic indignity. No one cares about Squaw Island. It is the Orphan of the Antilles, not in the least helped by the fact that Squaw Island (connected to Bird Island by a breakwater and land fill road) is the site of the Buffalo garbage incinerator and sewage treatment plant. There it is, for those of you who suspected, for those of you who knew, and finally those of you who looked into the Atlantic or Pacific waters for the Island of Squaw.

On March 31, 1971, a small band of hams made the trip to Squaw Island to set up the first Amateur Radio Station ever on this desolate piece of land. We found an excellent spot at the last digester tank which was built over land belonging at one time to Squaw Island. Digester tanks function like huge septic tanks. Bacteria work and feed on the waste and liberate gases which are incinerated to burn some of the solids that come from the sewage system.

April first is a bit early for the annual tomato plant sprouting which takes place at the solids dumping ground. Liquids are chemically treated and discharged into adjacent water. The garbage is disposed of in much the same manner of incineration except settling and digesting aren't required, just storage until room is available in the incinerator. An odor familiar, yet unusual, is first noticed when you arrive, but one gets accustomed to it after awhile. Two days and two nights usually do the trick, and it's only after you get home and get a whiff of that old pair of coveralls that memories are brought back.

The erection of the antennas was fast and workmenlike. W2RSJ had a connection with a crew that had access to a cherry picker crane that could be extended to a height of thirty-five feet. This facilitated matters, and we had

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everything ready but the living and operator quarters a day before "D Day."

Shortly after the travel trailers were parked and hooked up and the generator purring, we were paid a visit by a guy who could jump center on my basketball team any time. Let's face it, most hams look like refugees from an old Edward G. Robinson movie – I do – and this guy was no different. He greeted me with a bunch of call letters and then proceeded to follow me around like a pet dog. Never having been formally introduced, and having a lot of unattended gear around on the 31st of March, I was concerned about warm bodies roaming in and out of trailers, especially if no one knew who they were. I wondered how the "string bean" got wind of our location, since the local papers only carried a small item about the Mayor of Buffalo proclaiming the first of April as Radio Amateur Recognition Day, and the radio and TV stations had not carried the item because the release was for the next day. I decided to have all strangers not connected with the sanitation and sewage department evicted, and since Lee (WB2QDA) was a southerner and possessed the proper tone and command presence to evict strangers, the duty of ridding our encampment of strangers before Radio Amateur Recognition Day fell upon him. About ten minutes after my decree, Lee came into the operating trailer and informed me that "String Bean" bought his way into the expedition by offering us the use of his Signal/One, Collins 30L1 and a trapped "V." That in itself should buy anyone into a DXpedition. Now I listened a little closer: WB2OEU was his call, Fred was his name, and he had an Extra Class Ticket. I said, "Okay, you're in, but bring your own food, drink, and a bedroll." I got to know Fred quite well during the stay on the island, and much of our work on 75m was WB2OEU's fine operating.

We began using our own calls as portable to test the equipment about 1800 GMT and were disappointed that the propagation would not be optimum that evening. About 2100, strangers invaded the area and all indicated that they were hams. At one point there were twelve people watching operations in the operating trailer that could hold only four operators comfortably. Some of the scoffers came by to "help" after all the work was done and the fun ready to begin. Seven of us had done the leg and paper work, the assembly of equipment, the erection of equipment, and now we were being offered "help." One cigarette being snuffed out on my trailer floor and a paper cup of coffee atop my linear was not enough to arouse my ire – but when cables and cords were being upset, I saw red and probably made a lot of enemies among the ham community.

We logged nine hours of CW on forty with a little DX; we gave Squaw Island as the QTH. For those more curious we gave the geographic coordinates. Unless you're accustomed to copying three-letter code groups or you moonlight as a ship's radio operator, forget it. We have tapes of contacts who were given geographic coordinates and their comments are rare entertainment every time we listen to the playback. By 1100 GMT, twenty started to turn hot and we had a ball with European stations. We added a further clue to the location of Squaw Island, "We're four hundred miles from New York City." This disclosure placed us in the Atlantic Ocean to some listeners. Good Samaritans, helpful to a fault, began warning stations that we were bootleggers operating a 10 kW transmitter. We dropped another hint . . . we had a paragraph on page 101 of QST March 1971 issue . . . still we were thanked for a "New Country" by calling stations. Old residents of the area called in and went along with the DXpedition; one was so dumbfounded he said, "Why, that's the city dump!" I might add that some Good Samaritans recorded on tape cannot be found in any Callbooks, but they do have class in selecting calls.

What did we accomplish April 1st? Well, forgetting the work, we did have a lot of fun. We did set up a first-class operating facility efficiently and quickly that could be activated once again if an emergency arose. Amateur radio was

publicized in the press and the public was made aware of our existence. K2DSO appeared on TV for a full half-hour interview show. We have two speaking engagements booked to date; we have several shoe boxes of QSL cards to reply to, and what is most important, Rare DX came toward the U.S.A. for a change. Would we do it again? Well, maybe not Squaw Island, but there are other islands waiting to be conquered, and just yesterday the airline pilot member of our DXpedition (WB2QDA) suggested that he could get a "chopper" to airlift our party to the brink of Niagara Falls to give the world one of the Three Sisters Islands. How does KS2SSY sound? Or a station on Goat Island even closer to the brink of the falls, KG2OAT?

. . .WA2JLF■

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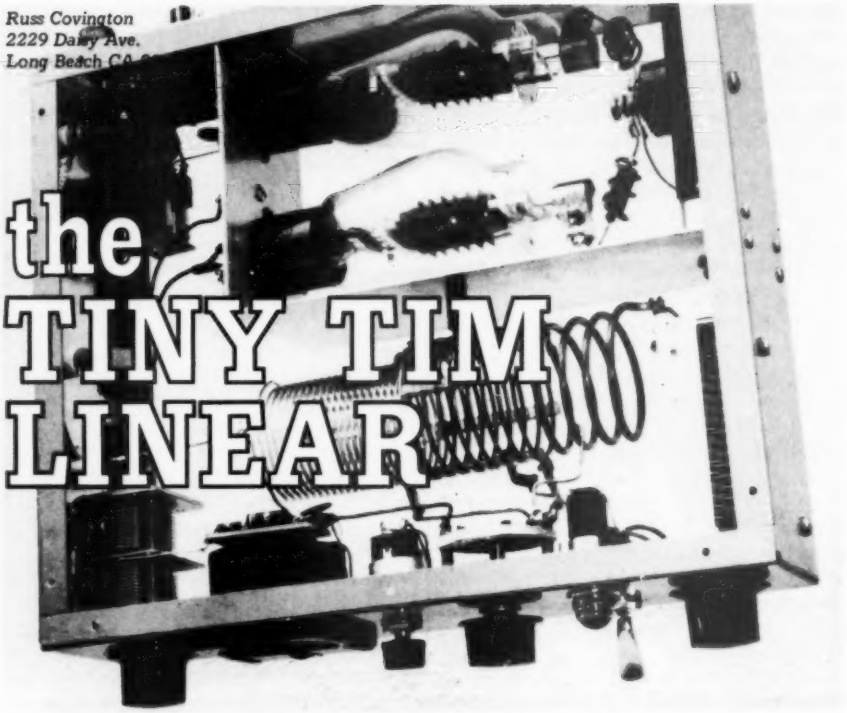
the TINY TIM LINEAR



Tiny Tim was born from the need of a little extra punch when using my SBE 33 from our small travel trailer. I knew it had to be small to please the wife in not taking up the much needed space. I discovered the best place to hide the ac power supply would be in a corner under the dinette seat.

Tiny Tim's body is only 3 in. high, 12 in. wide, 10 in. deep, and will tune 80–10 meters. It also includes a built-in antenna relay and an rf output indicator. It fits perfectly on top of the SBE 33, as shown in the accompanying photos, but is adaptable to other transmitters and transceivers. This compact linear will run 500W dc input on SSB with 1500V on the plates of the two 811As in grounded grid. I am running only 1200V on the plates and find this adequate for my needs.

Although I have only used an ac power supply with *Tiny Tim* a mobile dc supply of as little as 800V would provide an adequate boost for low-power transceivers. Even at this low voltage, it would deliver close to 500W PEP input. The 6.3V filaments are wired in series for possible use with a 12V dc system. The open chassis design gives good natural ventilation, along with ease of construction.

Tiny Tim was fun and easy to build, and should appeal to those hams in the very low income bracket like myself.

Tiny Tim Circuit

I decided on 811As because they do not need a bias supply and are not expensive for the power they deliver. They also work well following a low-power exciter, and require as little as 20W driving power on all bands. The circuit is nothing startling, but a proved one squeezed down for simplicity and compactness. Many parts can be scavenged from the junkbox, TV, and old radios. The filaments are kept above ground with a homebrew choke and

driven directly from coax input from the exciter. The plate choke is wound on a plastic rod and held in place at the ends. The plate tuning capacitor is from an old ARC-5 transmitter, and the antenna tuning capacitor is a two-gang type from an old radio with the stators wired in parallel. The tank coil is smaller in diameter than the garden variety used in most, but the Q is correct and works well. The extra contact on the tank switch can be used on 80 meters to add extra capacitance in cases where the load resistance happens to be unusually low or reactive.

The antenna relay is a four-pole double-throw I had, but a 5A three-pole is all that is needed. I used the third pole contacts to lift the filament centertap from ground on standby. This keeps the transformer much cooler. For those using *Tiny Tim* with the SBE 33, you will find 10V dc on the octal male plug at pin 7 for controlling the antenna relay, but be sure and use a two prong plug that is insulated from the linear chassis. Consideration should be given to the relay control voltage, if used with other units than the SBE. The output meter provides the necessary indication for loading the amplifier, and the 25 kΩ pot keeps the reading in the proper scale, along with a push-pull switch on the back to control the antenna relay for tuning just the exciter, or turning off the linear with the ac power switch still on.

Almost any of the power supplies shown with linears of this plate voltage requirements will work. I used an old husky TV transformer and a surplus capacitor with some bargain high voltage diodes. No choke is needed in my supply; this helps make the unit easier to hide.

Tiny Tim Construction

Tiny Tim is built inside a 3 x 12 x 10 in. aluminum chassis with the top cut out leaving a half-inch ledge the same as on the bottom. (See Fig. 1.) Allow extra diagonal metal in the corners for mounting the

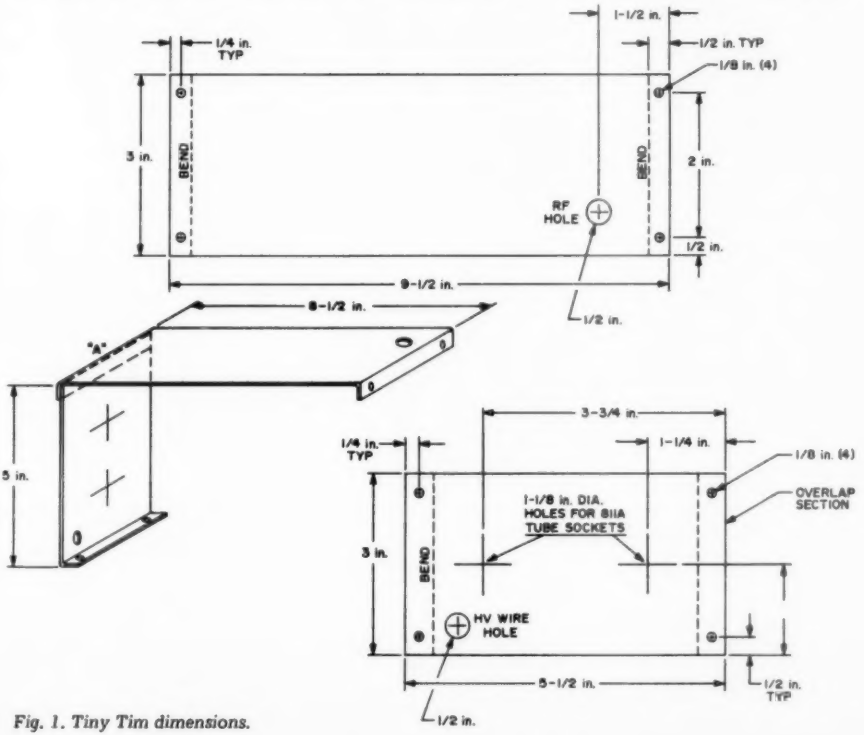


Fig. 1. Tiny Tim dimensions.

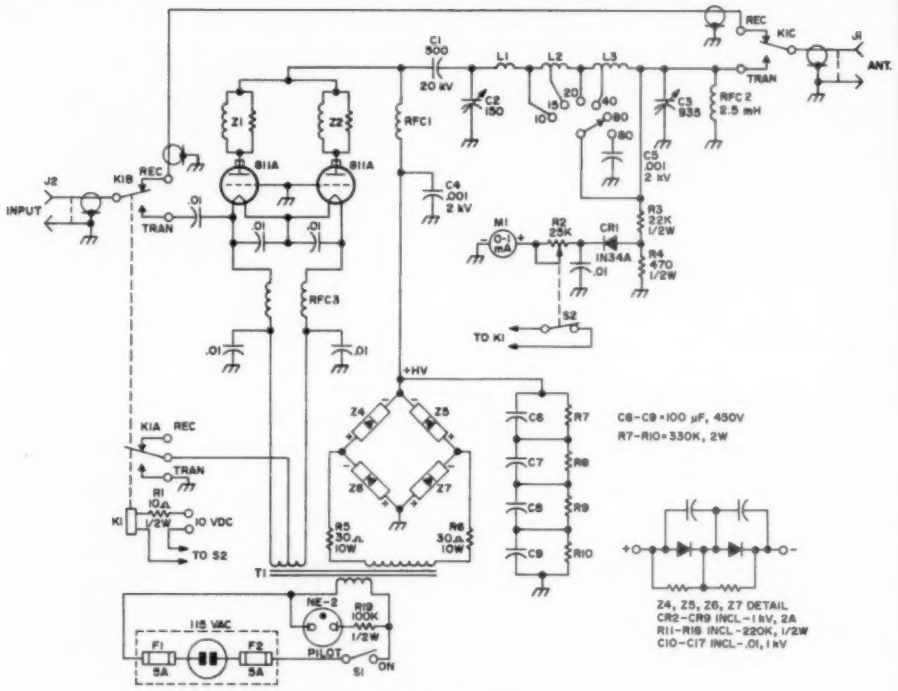


Fig. 2. Tiny Tim linear amplifier schematic diagram.

Capacitors

C1 – 500 pF 20kV TV-type high voltage (Allied 43A5599)
C2 – 150 pF var. (Johnson 250E20)
C3 – 935 pF var. (Allied 43A3528)
C4, C5 – .001 µF 2kV ceramic (Allied 43D6290)
C6–C9 – 100 µF 450V electrolytic (Allied 43A4547)
C10–C17 – .01 µF 1kV disk ceramic
CR1 – 1N34A
CR2–CR9 – Silicon diodes - 1kV 2A each

Note: All capacitors 600V ceramic unless otherwise listed

Resistors

R1 – 10Ω 1/2W
R2 – 25kΩ pot with push-pull switch (Lafayette 33E14838)
R3 – 22kΩ 1/2W
R4 – 470Ω 1/2 W
R5,R6 – 30Ω 10W
R7–R10 – 330 kΩ 2W
R11–R18 – 220 kΩ 1/2W

Parts

T1 – TV power transformer 350 mA (with 4A fil)
S1 – Single-pole single-throw toggle (Olson SW412)
S2 – Push-pull SPST switch on back of R2
S3 – Single-pole, 6-pos. ceramic rotary (Centralab 2501)
K1 – Relay 4-pole, double-throw, 5A contacts, 6V coil (Olson SW468, Potter & Brumfield GA23671)
RFC1 – 90 µH, 500 mA 4 in. closewound No. 26 Formvar on a 5 in. long, 3/4 in. dia solid plastic rod
RFC2 – 2.5 mH rf choke
RFC3 – 28 bifilar turns No. 14 Formvar or Nyclad wire closewound on 1/2 in. dia, 5 1/2 in. long ferrite rod (Lafayette 32R6103)
L1 - 4 turns, No. 10 wire, 1 3/4 in. inside dia, 1/4 in. spacing
L2 – 8 turns, 2 in. dia, 4 tpi (AirDux 1604)
L3 – 21 turns, 1 3/4 in. dia 8 tpi (AirDux 1408)
COIL BAND TAPS – All taps measured from end of C2
10m 2 1/2 turns
15m 4 1/2 turns
20m 7 1/2 turns
40m 17 1/2 turns
80m all of coil
M1 – Dc milliammeter, 0–1 (Allied 52A-7614)

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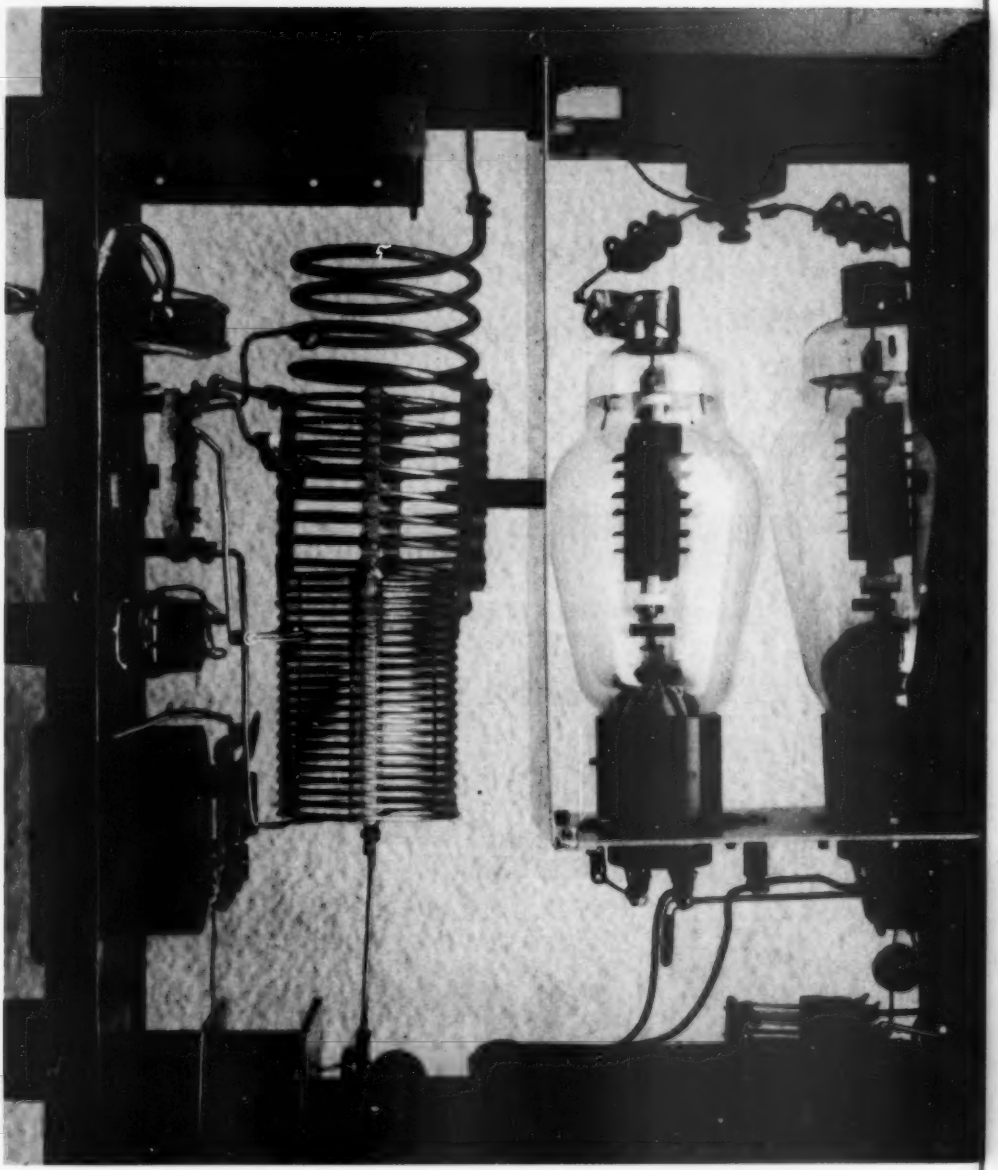

Inside of Tiny Tim.

I1 – Ne-2 panel mount neon lamp
J1,J2 – Coax connector, chassis mounting (SO-239)
F1,F2 – 5A fuse, fuse-in-plug assembly
Z1,Z2 – Parasitic suppressor, 100Ω 2W carbon resistor assembled inside 2 1/2 turn coil of No. 16 tinned, 1/2 in. dia, 3/4 in. long

Amplifier chassis – 3x12x10 in. aluminum (Allied 42A7854)
Power supply chassis – 3x5x13 in. aluminum (Allied 42D7906)
Minibox 2x3x5 in.
Male/female, multiwire connectors series 78 and 86, eight contacts (Allied 47D0528 and 47D0508)

rubber feet. Cut two 3 in. strips from the leftover scrap for the rf section divider, and assemble as in illustration. Care should be taken on construction of the divider as the tube tolerance is quite close.

It is important that the filament pins (large holes) on the tube socket should face each other on assembling to prevent filament sag. Although the tube filaments are shown in series for a 12.6V transformer, they could be paralleled for 6.3V.

High-voltage blocking capacitor C1 (Fig. 2) was taken from an old TV high voltage cage and screwed into a half-inch standoff insulator.

Plate choke RFC1 was constructed of plastic rod cut to 5 in. in length, tapped at both ends for mounting screws, and also tapped at the sides for the start and finish position of the winding.

The three sections of the tank coil were first cut to the right number of turns, then soldered to the end turn of each coil, and held together, where the plastic sections meet, with epoxy cement. Centering of the tank coil in the chassis is important to its

RF choke and 811A mounting detail.

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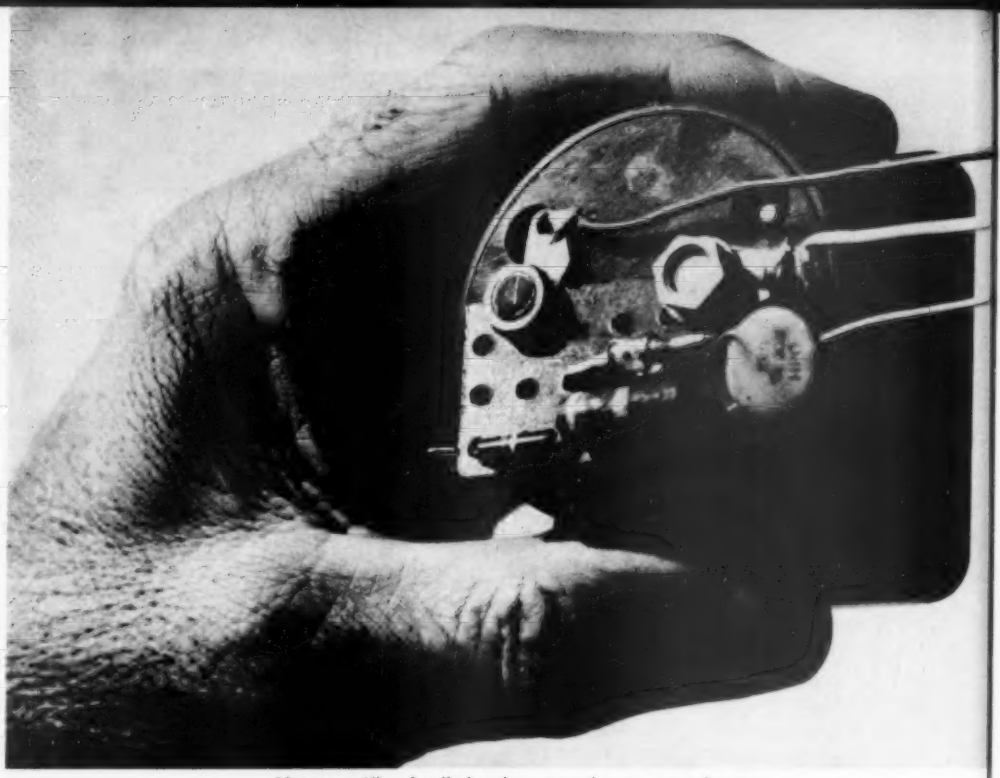


Meter rectifier detail showing mounting on rear of meter.

operation. The coil is held at the center by a standoff insulator secured to the rf divider, but care should be taken when soldering to the turns of the coil that you don't short out the next turn.

The filament choke is made by winding two side-by-side (bifilar) lengths of 14-gage wire on a 0.5 in. ferrite core cut to 5½ in. Leave enough length on the ends of the wire to reach to the power plug and filaments. Make one wrap of plastic over the core before starting your winding. A couple of plastic straps screwed to two standoff insulators hold the choke firmly to the side. RFC2 is mounted on the same side at the end of antenna tuning capacitor C3.

The metering rectifier unit is all mounted on a 2 x 2 in. Vector board, and held to the back by the meter lugs.

The three wires from the ac power switch are run in shield under the chassis ledge to the power plug on back. High-voltage capacitor C4 and the filament bypass capacitors are mounted at the power plug.

The top and bottom covers of the amplifier are cut from a sheet of perforated aluminum (do-it-yourself type) available in most hardware stores, and held in place with metal screws.

In trying to keep my ac power supply small as possible, I sacrificed a few watts by using an old TV transformer instead of the higher voltage one I intended to use. After building a bridge rectifier, the dc no-load was just over 1200V. The on-the-air reports are so good that I am not sorry for my choice. The transformer was fastened on its side inside of a 3 x 5 x 13 in. chassis with the filter capacitor secured at the other end. Placing a piece of plastic under the capacitor helps to reduce any possible flashover. There is plenty of room left for the standoff insulators and resistors.

Fasten a piece of pegboard over the capacitor area, leaving a 2 in. space from

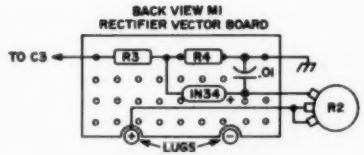


Fig. 3. Meter rectifier board.

the transformer for the barrier terminal strip. On top of the pegboard is fastened a 2 x 3 x 5 in. minibox that holds the rectifier diodes on two terminal strips with the leads going out the bottom. The shielded rubber covered 8 ft power cord passes all the way through the cover, with the leads screwed to the terminal tie strip. Another piece of pegboard over the terminal block area will completely eliminate the possibility of accidental shock.

A male type TV ac connector, mounted flush on the side of the chassis, is a safe quick way to be sure your power is completely disconnected.

Half-inch rubber feet are mounted at the four corners with metal screws, the same as on the linear.

Check all wiring at the relay and power plug with an ohmmeter for possible shorts before applying the smoke test; it may save a few parts.

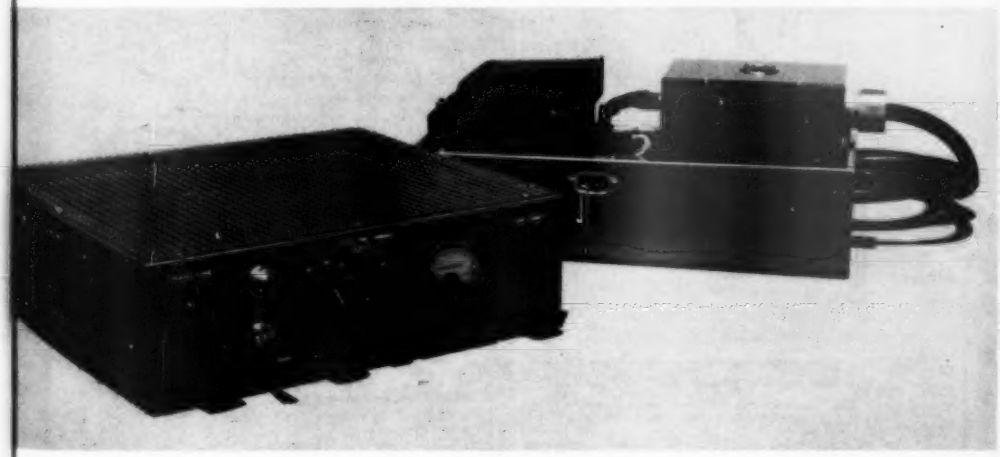
Keep in mind that although *Tiny Tim* is small, the knockdown voltage is big and you might not get up.

Tuneup Procedure

Load your exciter into a 52Ω dummy load with linear amplifier relay switch S2 off. Note that the antenna relay is still active with S2 on, even when the linear ac power switch is off. After normal exciter loading, turn on antenna relay switch S2, and center the meter output control. Switch your exciter momentarily to tune, and swing plate tuning capacitor C2 for the most output indication on the meter. Repeat with antenna loading capacitor C3, and again with C2 until you have peaked the output with the meter set in the upper scale.

To check for proper operation of the tank circuit for efficiency on each band, antenna loading capacitor C3 stator plates should be considerably less than fully meshed. This can easily be corrected by changing the band tap, and adding one more turn to the tank coil.

After loading the linear on your favorite band, carefully loosen the setscrews on the tuning knobs C2, C3, and the output meter control knobs, adjust so that the knob markers are all vertical. This will give a reference for future tuneups. . . .WA6VLI■



Tiny Tim and AC power supply. Note male AC connector on power supply and the box over the diodes.

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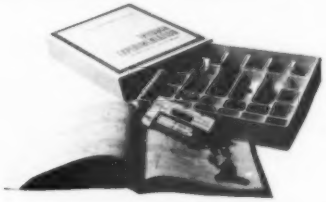

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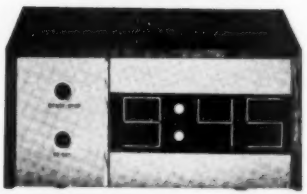

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K6MVH's "Gain Antenna for VHF/UHF Repeaters" is not really so non-critical that all dimensions can be left to the reader's imagination. Neither can it be said that we purposely deleted the dimensions to test how alert our readers really are. Actually, somebody goofed and forgot to put the dimensions onto Figure 1. The dimensions for this antenna are: 2 meters: A = 19", B = 13.3", C = 26.6". 450 MHz: A = 6.33", B = 4.44", C = 8.875". 220 MHz: A = 12.66", B = 8.88", C = 17.75".

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The four-tube station is the result of a long-time desire for a small, compact transmitter-receiver combination that will work well on 80 and 40 meter CW. I wanted it to be ready to go at a moment's notice, either as a standby rig at home, or on that occasional vacation trip.

The Receiver Section

Three of the four tubes are used in the receiver. The other is in the transmitter. You probably are already questioning how well a three-tube receiver will work on these two crowded bands. Take my word for it: it works real well. A 6EA8 is used as the mixer-oscillator, a 6BA6 serves as a regenerative i-f amplifier, and a 6GW8 is the first audio and audio output stage.

Much of the success of the receiver can be attributed to the i-f amplifier. By using regeneration the gain and selectivity of the receiver is increased greatly. The i-f is 1700 kHz, so image problems are reduced considerably. By using this frequency the oscillator does not have to be switched when changing bands. It tunes from 5.200 to 5.700 MHz. With a little mental arithmetic you can see that this will give a 17.00 kHz difference when the antenna circuit is tuned to either 80 or 40. The antenna circuit is tuned by a variable capacitor with sufficient capacity range so that both 80 and 40 can be covered; so no bandswitching is necessary in the receiver.

Both the antenna and oscillator coils are wound on ½ in. slug-tuned forms. This makes it possible to adjust the inductance to just the value needed without a lot of trouble.

A 1N34A general purpose diode is used as the second detector. This is followed by the 6GW8 which provides plenty of audio for speaker operation. The headphone jack is a two-circuit type. The two circuits are tied together; this arrangement is used to allow use of the low impedance stereo type headsets that are so popular now.

The Transmitter Section

A 6146 is used as a grid-plate crystal oscillator. With the power supply shown it is possible to run about 40W input. The circuit is very simple. A pi-network tank is used in the plate circuit so that the transmitter will match any 50–70Ω load. Both the plate tuning and antenna loading capacitors are the cheaper broadcast type. The latter is a two-gang affair with the sections in parallel.

The plate tank coil is wound on a 1¼ in. plastic pill bottle. So that the inductance and capacity will be right for each band, the coil is tapped and a cheap slide switch is used to short out a portion of the coil on 40 and in the 80 meter position additional capacity is added across the antenna loading capacitor.

The Power Supply

The power supply is a straightforward affair using silicon diodes as rectifiers and a simple RC filter. The transformer can be from an old TV receiver, or any other transformer capable of delivering 350V dc at 125 mA or more.

The send-receive relay is a standard four pole, double-throw job. Only three poles are used. The coil is designed to operate on 117V ac. A toggle switch controls this relay. Another toggle switch is used as the main power switch.

Construction

The four-tube station is built on a 7 x 11 x 2 in. aluminum chassis. Before you

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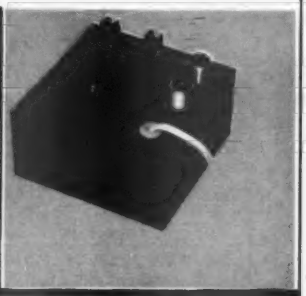

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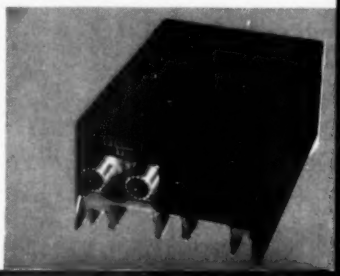

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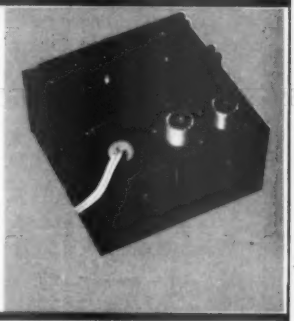

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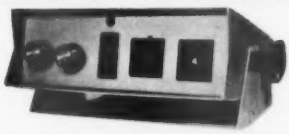

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begin construction, take a good look at the photographs so that you can get a good idea where to mount the major parts. The layout is not extremely critical, but I suggest that you follow the same general arrangement.

Arrange the major parts and mark their location so that the necessary mounting holes can be punched or drilled. Mount these parts. Before you mount the 25 pF receiver tuning capacitor it would be wise to lay out the front panel so that the dial can be mounted. There must be good alignment between the dial and the capacitor so that the tuning will be smooth.

You will note that liberal use is made of terminal strips so that the smaller parts are held in place securely. It would be wise if the coils in the receiver, as well as the one in the transmitter, are coated with a good grade of coil dope.

The front panel on my rig was cut from a sheet of prefinished Masonite. It is 3/16 in. thick and measures 7 x 12 in. The controls are labeled with decals.

I left the installation of the relay until last. When it is mounted connect the proper wires to it. Small coax is used in the antenna circuit. Be very careful in connecting the leads to the relay. Be sure you are right.

With the rig plugged into a 117V ac outlet, the tubes in their proper sockets and a speaker connected to the speaker jack; turn the ac on. After about a minute of warmup time, you should hear a slight hum from the speaker. Turn the regeneration control fully clockwise. This puts maximum screen voltage on the i-f amplifier. You should hear background noise with this setting. If you have a 1700 kHz signal source you can align the i-f very easily. Connect a VTVM between the capacitor side of the 1N34A second detector and the chassis and adjust the four slugs of the two i-f transformers for maximum indication. As the i-f amplifier is aligned it will be necessary to back down on the regeneration control to keep the i-f from oscillating.

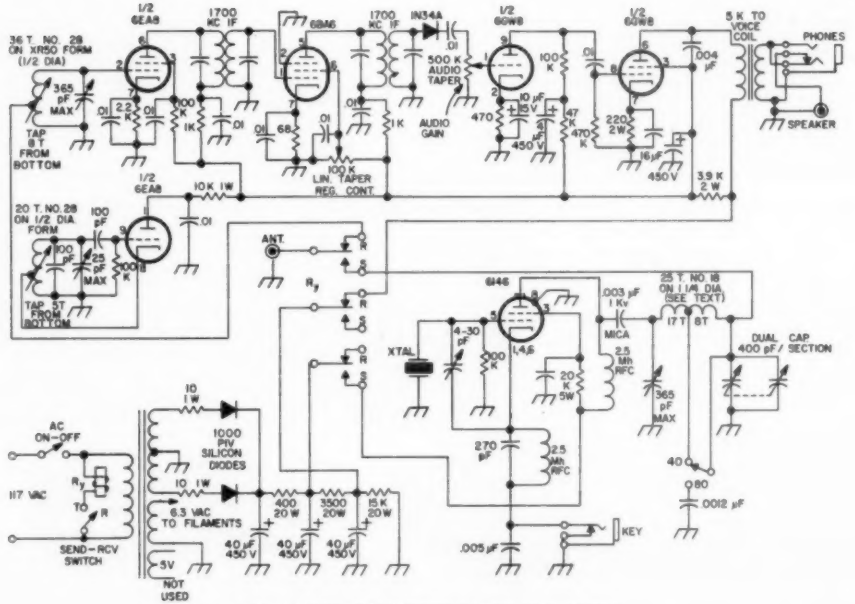
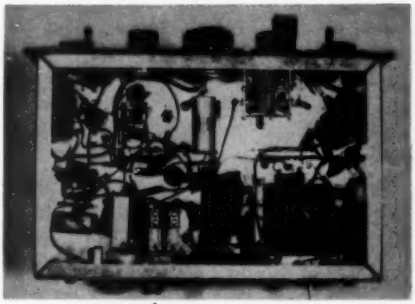


Fig. 1. Schematic diagram of four-tube station.

Next set the oscillator. This can be done in a number of ways; probably the simplest is with a general coverage receiver. Set the general coverage receiver to 5.200 MHz. With the dial tuned so that the tuning capacitor is fully meshed, slowly adjust the slug of the oscillator coil until a signal from the oscillator is heard in the other receiver. This signal will be easier to hear if the bfo is on. With the tuning capacitor set to minimum capacity you should be able to hear a signal near 5.700 MHz.

Tune in a signal near 3.500 MHz and with the antenna tuning capacitor fully meshed simply adjust the slug in the antenna coil for maximum signal.



Underchassis view of transceiver.

Adjustment of Transmitter

With either a 40 or 80 meter crystal in the crystal socket, a key plugged into the key jack, switch the transmitter on. Press the key and listen to a nearby receiver tuned to the crystal frequency. If the transmitter is oscillating you will hear it. If not, you will need to adjust the compression-type trimmer capacitor located in the 6146 grid circuit. This capacitor should be adjusted so that the oscillator starts smoothly when the key is pressed. Caution: Do not hold the key down too long – the plate circuit is off resonance!

The tuning of the plate circuit is like any other pi-network. To check out the rig a 25–40W lamp connected to the antenna connector will serve as a dummy load. A 200 mA meter plugged into the key jack will help in loading up.

...W5LET■

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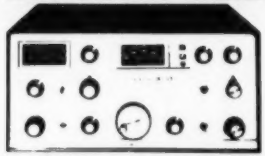

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All's Well In Amateur Radio?

We are not losing our bands, we are gaining bands, our numbers are increasing at the rate of CB at 100,000 per year, youth is flocking to our hobby, we have only one representative to the FCC, our ranks are not divided into incentive vs non-incentive, CW vs Phone, etc., our wonderfully efficient ARRL is not losing money but is furnishing $2,000,000 a year as a nonprofit organization to run its powerful lobby from its Washington headquarters, our efficient management team as moved ARRL headquarters from that quaint little town, Newington, Conn., where the inaction is, to Washington where the action is. QST is now a first-rate reporting medium where you can read both sides of the story, almost all amateurs now belong to the ARRL, there is a very powerful world amateur organization, our public image is phenomal, and everyone knows about and loves amateur radio and last, and not the least, we have a 10-year written plan to plot a course for amateur radio that is supported by and contributed to by the powerful EIA lobby in Washington. Now let's put down our opium pipe and look at the facts.

Prophet of doom? Or realist? Take a look at the graph in Fig. 1 whose figures are taken from the FCC Annual Reports of the years 1958 through 1969. These figures are official fact and cannot be refuted. This slow-down in amateur radio growth and low percentage of amateurs in the ARRL is one of the key problem areas. Unless this trend is stopped, our hobby will slowly die.

This graphic picture is better than 10,000 words. It presents the basic problem in a nutshell. However if you look beyond these figures, and interpret what they are saying, the facts are pretty gruesome. CB, while it has only 860,024 stations, the total including mobiles licensed is a staggering 3,372,525. It is relatively simple to see that this is where the manufacturers are looking for a market and that's why the manufacturers through the EIA are pushing the FCC for more frequencies for CB.

It is interesting to note the membership in the ARRL pretty well follows that of the slow growth or even loss in numbers of amateur radio. The drop in membership, 35% in 1962 to 28% in 1969, closely follows controversial decisions made by the ARRL Directors and the lack of selling the decision by headquarters via QST. We make no real effort to sell all the amateurs on the ARRL. The only single written effort is that when a person receives a license from the FCC he gets a letter from the ARRL requesting he join. The only other effort is the corny outdated ARRL booth at various functions that is always

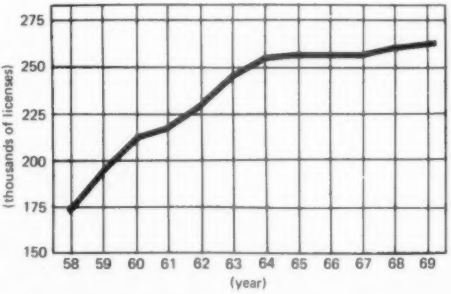

Fig. 1. Graph of total licenses issued from 1958 to 1969.

undermanned. Amateurs just won't flip over and play dead and accept the great ARRL. They must be sold and that requires public relations, good advertising outside of QST, and more important, a truly representative ARRL that expresses the desires of *all* amateurs.

Many questions arise that should be answered. Why has amateur radio growth stopped? Why is the ARRL membership so low? What has happened to the once very successful and agressive ARRL? Why has it lost respect at the FCC? Why is it losing money? Why are our bands being nibbled away? Why is youth not interested in amateur radio? What has happened to a once successful operation that has now become stodgy and ineffective? Why isn't QST a real reporting medium that prints both sides of the story? How good is its leadership? What can be done to revitalize the ARRL and amateur radio? Why don't we have a long-range plan?

Every successful business has a long- and short-range plan. How can you project finances without one? How can you anticipate change and hazards without one? Without a plan you are like a ship at sea with no destination, buffeted around by the wind and waves, never getting to shore unless it's by accident. Why do we resist change?

Change is the Name of the Game

Last year the "EIA" (Electronic Industries Association) went through a rather drastic organizational change. The NAB (National Association of Broadcasters), the largest and most powerful lobby in Washington, had an organizational renovation to make it more effective. Hundreds of corporations continued the realignment of their organizations to reflect changing conditions and to show a better return on their investment. Why do we amateurs resist change? Those who resist change generally die. Take a look at the old problems: the same old contests, the same old arguments, the same old names, the same old "lots of talk and no action" and so on, ad infinitum. We have been doing the same old things in the same old way since the birth of amateur radio. While we are complacently sitting, a population explosion, communication revolution and drastic world changes are swarming around us. We are like Rip Van Winkle – we are waking up in an entirely different, highly-competitive world. Only we are not like Rip; we h aven't awakened as yet.

There are several things that can happen to amateur radio. Things can go on as they are with our ranks divided, other entities using and taking our bands, our real growth stopped, youth not very interested, our former mainstay, the ARRL, losing its effectiveness, losing the respect of the FCC, losing money. The League, which represents less than thirty-five percent (35%) of the amateurs, has become complacent and stodgy and is in general need of revitalization. Amateur radio will certainly slowly die as we are! Or we can make a turn-around and again be the highly respected healthy entity we once were. It's your responsibility – isn't it time for action?

. . .Wells Chapin■

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What bands would you like to see used?
What modes?
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Any suggestions?

Please send to:
DX Editor
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A DIGITAL READOUT FOR YOUR VFO

Richard Factor WA2IKL
Fed. Scientific Corp.
615 W. 131st St.
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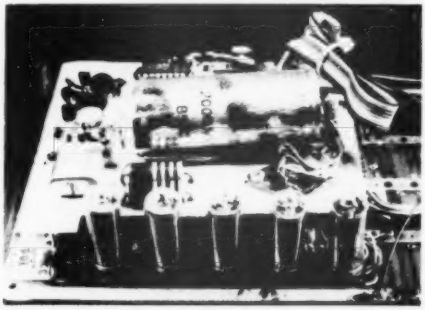
Are you on frequency? Are you within the band? Incentive licensing subbands have made this an increasingly difficult question to answer. Even if you have an Extra license, it is still nice to know where you are for net operation, OO work, etc. The declining price of integrated circuits and readout devices has made it unnecessary to continue to drool over the advertisements for that $1600 transceiver with the digital dial. A large percentage of currently manufactured gear can be fitted with a digital dial with greater accuracy, and very reasonable cost. Little modification of your gear is required, and what is required will not affect the resale value, since it is invisible and is easily removed.

As an extra added plus for the homebrewer, the digital dial makes unnecessary the greatest hate object of the electronic purist; the tuning dial; with its attendant impossibilities of getting linearity, accuracy, and above all, of inscribing, decaling, engraving, or calligraphing the dial in a neat, readable manner.

The device to be described is an adaptation of the basic electronic counter circuit. It takes the vfo signal of your receiver or transmitter and tells you what it is. Accurately. Not to the nearest kHz (with luck,



Front view of digital dial showing sandwich construction.

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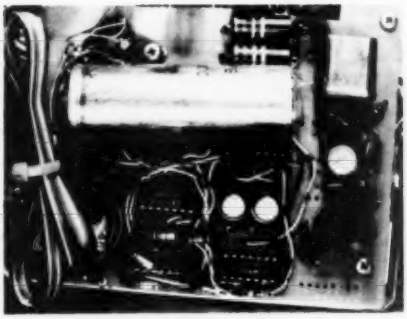


Top view of power supply and timing section.

at 57.8% relative humidity, with the rig on a cast iron bench weighted with two tons of sand and suspended in a mercury pool) but rather down to the nearest 10 Hz, almost always, with no precautions or requirements other than a periodic check to zero-beat the oscillator with WWV. If it is installed in a transmitter, it can measure received signal frequency by zero-beating the transmitter with the receiver. It can also measure frequency shift of an RTTY signal by zero-beating the mark and space frequencies and subtracting the two readings.

You know frequency counters are expensive and you're scared away by the price. Right? You shouldn't be – I mentioned that IC and readout prices are declining. Below is a comparison based on the advertised prices of the major components involved. I haven't included resistors and small components because you no doubt already have them. Even if you don't, the total should be less than $10. It is assumed that your rig has high voltage and filament supplies so that no power transformer must be bought.

Type	Quan	Total
SN7490	10	$20
SN7475	5	$10
SN7441AN	4	$12
B5750 (Nixie)	5	$25
1MHz Xtal	1	$ 5
		$72

This is effectively for the "worst case." i.e., no external oscillator, using 1 MHz crystal, 5-digit readout with storage. By eliminating the 10 Hz resolution, using an existing 100 KHz calibrator, and deleting the most significant digit, the price becomes drastically lower.

Type	Quan	Total
SN7490	7	$14
SN7441AN	3	$ 9
B5750	3	$15
		$38

The following parts are available from Circuit Specialists Co., Box 3047, Scottsdale AZ 85257. MPS 6520 98¢, MC724 $1.10, SN7400 45¢, SN7475 $1.50, SN7441AN $2.75, SN7490 $1.90. Add 35¢ for shipping.

Since dial drive mechanisms with less than one tenth the accuracy cost over $30, the price is not at all out of line. Incidentally, the prices quoted above are the highest you should have to pay. Due to a current oversupply in the IC industry, substantial discounts may be obtainable, and there is little doubt that prices will drop substantially between the time these words were written and the time the article appears in print.

Now that you have decided to build the digital dial, let's see if its circuitry makes it compatible with your rig. The rig should have crystal-controlled front end or conversion oscillator and a vfo covering a reason-

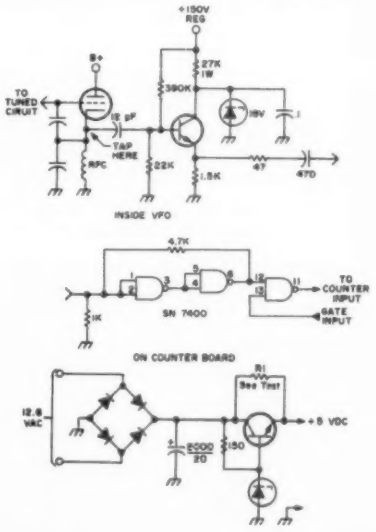


Fig. 1. Vfo isolation, input circuit, and power supply.

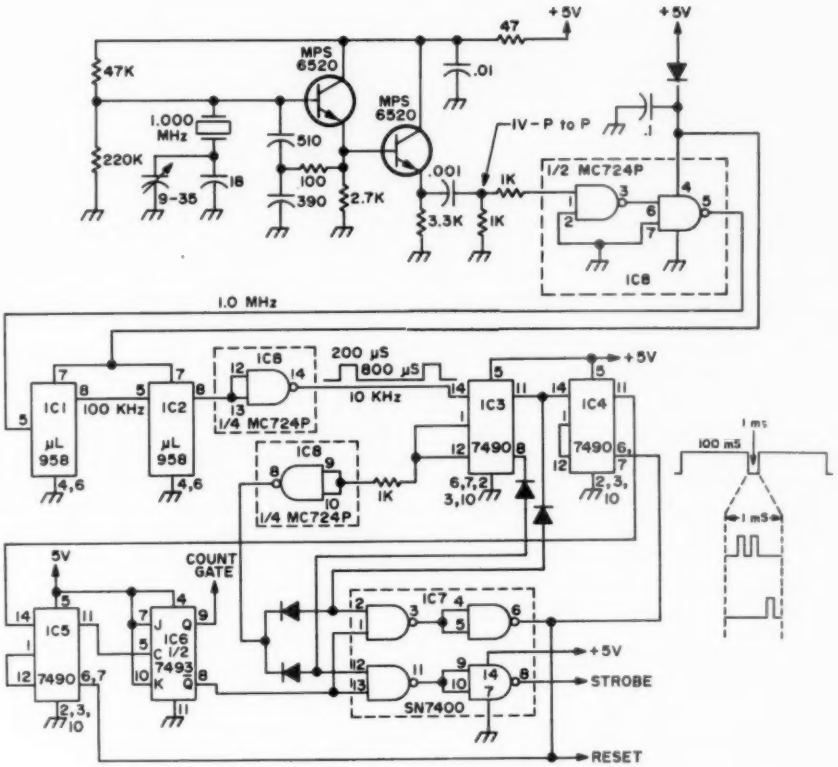


Fig. 2. Frequency-standard oscillator and counter control circuitry with timing diagrams.

able frequency range without odd number kilohertz tacked on. Ideally, a range of from, say 5.000 to 5.500 MHz would be covered. The unit can be used with a unit whose vfo covers, for example, 5.300 to 5.800 MHz with only minor changes. Input frequency is unimportant – anything up to 15 or 20 MHz is okay with the ICs specified. What is important is that there be no odd numbers at the end. A vfo covering 5.455 to 5.955 would be unacceptable. Of course, the counter will measure such frequencies as well as any other, but they will be impossible to mentally relate to the operating frequency. Another requirement is that the frequency mixing scheme be either additive or subtractive, but not a combination of the two. A quick glance at your instruction manual will tell you the exact vfo frequency and mixing scheme. If your rig tunes in the same direction on all bands, you should have no problem with the additive/subtractive question. If your rig does not fit the above criteria, I'll have a few comments on possible remedies, untried but theoretically sound, at the conclusion of the article.

The digital dial described herein is being used with my HX500 transmitter, whose vfo is 3.9–4.4 MHz, and which employs subtractive mixing. However, the principles and circuitry can be used with only minor modification in any transmitter or receiver fitting the above criteria.

The Circuit

The first step in going digital is to modify your rig. The digital dial needs +5V

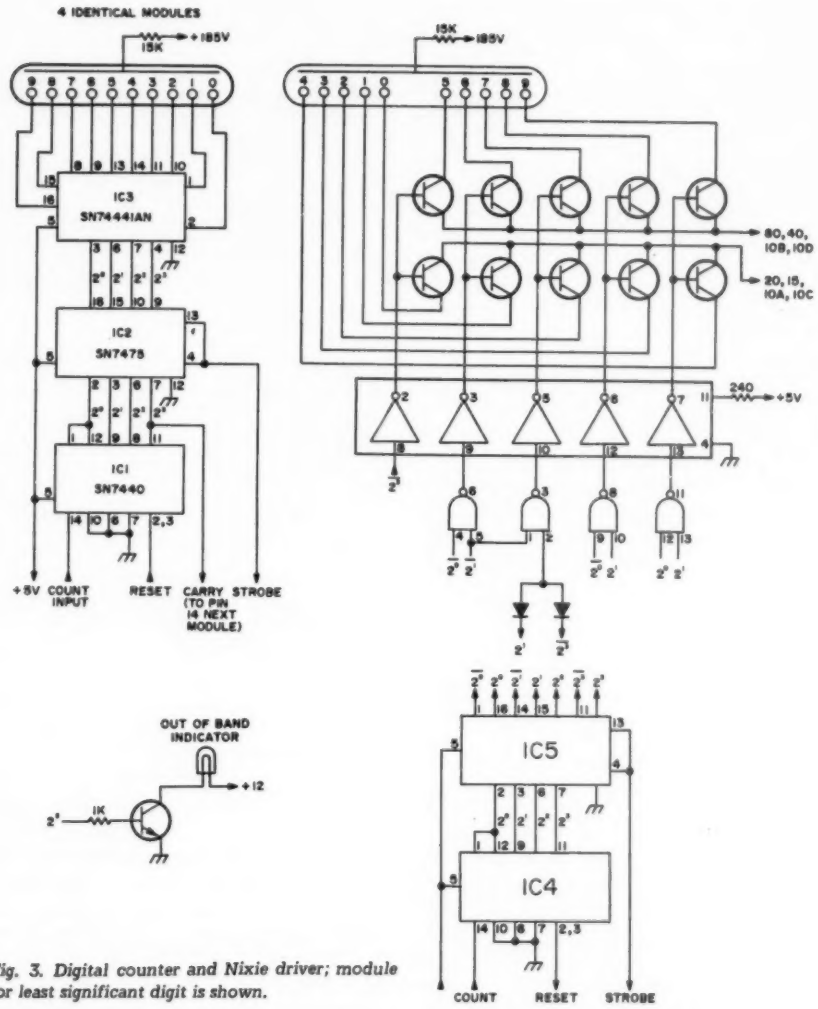


Fig. 3. Digital counter and Nixie driver; module for least significant digit is shown.

dc at about 500 mA, B+ at about 15 mA, and 1V of signal at the vfo frequency. To get the 5V, tap the filament supply (6.3 or, preferably, 12.6V and connect it to the bridge rectifier shown in Fig. 1. If your filament supply is 6.3V, it may be necessary to connect another 6.3V, 500 mA transformer in series with the filament supply. Nixie tubes like 170V at about 3 mA across them, but since they tend to act as voltage regulators, current limiting is necessary. Measure your B+ supply, subtract 190V, and calculate a resistor that will give 3 mA per Nixie with this voltage across it. Be sure to make a power calculation also, as a 2W resistor may be required. Small series resistors are connected to each Nixie to equalize current; the resistor just calculated goes to the junction of the series resistors.

The purpose of the vfo buffer is to make sure that the vfo in the rig is not disturbed. An emitter follower is ideal for this application. The component values

shown are for a supply of 150V, as this is the most commonly used. No trouble should be encountered if the pickoff capacitor (12 pF in the schematic of Fig. 2) is at least an order of magnitude smaller than the capacitor from the cathode to ground. The actual capacity will be much smaller, since the pickoff capacitor is in series with the transistor base, but it doesn't hurt to be safe. This completes the necessary modification of the rig. No damage to the front panel – see?

Circuit Description

The theory behind the electronic counter is that the number of cycles of the signal in a given period can be counted. If the period, for example, is 1 second, the number counted comes out to be cycles per second. Deriving the period precisely is done by counting down an accurate reference oscillator and then using the counted down signal to gate the signal to be measured.

The circuit works as follows (see Figs. 3 and 4). The input signal goes into a divider chain, the first stage of which is the least significant digit. After 10 pulses, the first stage is reset and a carry pulse generated. Since the counter has five stages and the counted frequency is in the MHz range, you can see that the counter will overflow several times during each count interval. However, we know what the first digit will be, so there is no point wasting a counting stage on it. All the stages are identical except for the most significant digit, which uses discrete components since special decoding is required.

After the counters have counted, the SN7441AN decoder/drivers ground the appropriate Nixie cathodes and the corresponding numbers light up. Between the counters and the decoder/drivers, one additional stage is necessary – a buffer storage register. The reason for this is that the gate time is 0.1 second, which will cause blurring during counting. If you wish to read out once per second, this isn't too bad. However, the dial is more useful when it's responsive, and you can zero in a frequency much more quickly when you don't

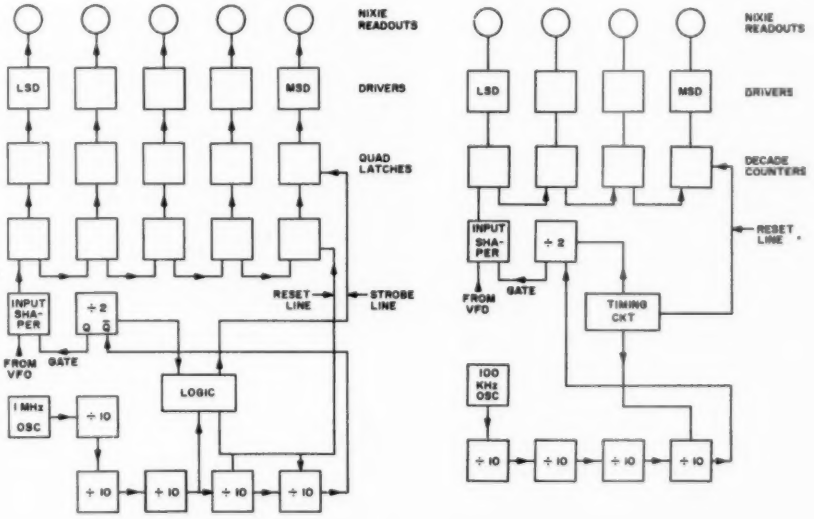


Fig. 4. Logic block diagram. The left block gives readout in 10 Hz increments at 101 ms intervals without blurring. The right block reads in 100 Hz increments; the update is adjustable and blurring occurs during 100 ms count.

have to wait a full second to see where the dial turn took you. By using storage registers and a few logic gates, it is possible to make ten 100 ms measurements in 10.1 seconds with no digit blurring. How this is done brings us to the timing circuitry.

First, an accurate frequency must be generated. The circuit shown in Fig. 2 is a stable oscillator designed for 32 pF crystals. A trimmer is included for fine frequency adjustment. There is no reason why the 1 MHz output of another oscillator can't be used. Approximately 1 V (peak-to-peak) is required. You can also use a 100 kHz oscillator and delete one divider stage. The MC724P quad 2-input gate shapes the signal into a square wave suitable for triggering the dividers.

The first two dividers I used in my unit are Fairchild μL958s. I used them because I had them lying around, and it is okay to use SN7490s here. A section of IC8 is used as a buffer to make the two IC families compatible. If you use 7490s, delete this gate.

ICs 3, 4, and 5 are the remaining dividers. At time zero, let us suppose that IC6, the gate flip-flop, is reset (gate at logic 0). The carry pulse from the last divider brings the gate high, starting the count. One carry pulse later (100 ms), IC6 is again reset, stopping the count. (The abbreviation "ms" means milliseconds; μs" means microseconds.)

Here the fun begins. IC6 Q, being high, sets half of the *and* condition on the first two sections of IC7. IC3 is still counting from binary 0 to binary 9 at a rate of 1000 times per second. Its output states are decoded by the remaining inputs to IC7 in the following sequence: At binary 4 and 6, pins 12 and 13 are both high, causing pin 11 to go low, pin 8 to go high, and thus strobing data into the buffer register. The strobe is performed twice because doing so eliminates the need for an additional decode – the same data is strobed each time.

At binary 8, pins 2 and 1 of IC7 are both high, causing pin 3 to go low and pin 6 to go high, thus resetting the counter and resetting the last two 7490s in the dividing chain. However, these two dividers are reset to 9 instead of to 0. This means that just 0.1 millisecond later, when IC3 carries, IC4 and IC5 will also, starting the count again. Note that the total time between the end of the first count and the beginning of the next is just 1 ms, allowing almost 10 measurements per second.

Backwards or Forwards?

If your rig is of the subtractive mixing type, you are probably wondering how the readout frequency corresponds to the output frequency of the rig. It doesn't – everything is upside down. Of course, it will be accurate on one frequency in the middle of the band, but that's little comfort. Despair not. Instead, connect the Nixies to the counter backwards. (Switch 0 for 9, 1 for 8, 2 for 7, 3 for 6, and 4 for 5.) Through the magic of mathematics, for every 10 Hz increment of the vfo frequency, there is a 10 Hz decrement of the readout frequency. You can now see why I said that the rig can be additive or subtractive, but not both . . . unless you happen to have a two-position, 50-pole switch around.

Most Significant Digit

The one remaining readout problem is that of the most significant digit. If you want the digital dial to be accurate on all bands it must read: (3)745.92 kHz on 80 meters, and (7)245.92 kHz on 40 meters. One way this can be done is to have different drivers for the Nixie, and ground the appropriate one with an extra wafer on the band switch (see Fig. 5). By driving the bases in parallel and grounding the emitters of the appropriate group, a cheap and dirty "adder" is constructed.

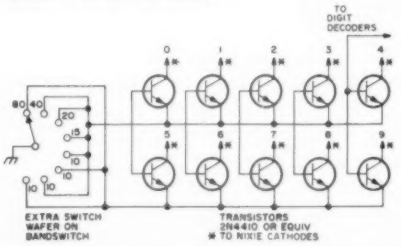


Fig. 5. Using a wafer switch to ground the appropriate Nixie drive for "adder" function.

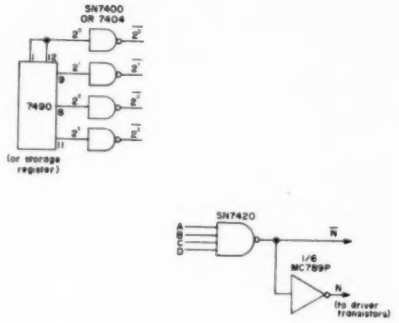


Fig. 6. General decoding scheme for all BCD states.

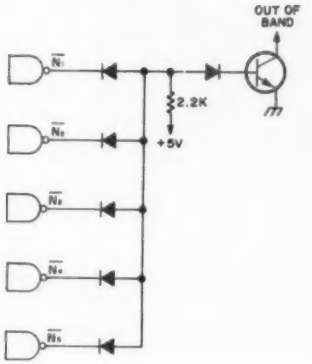
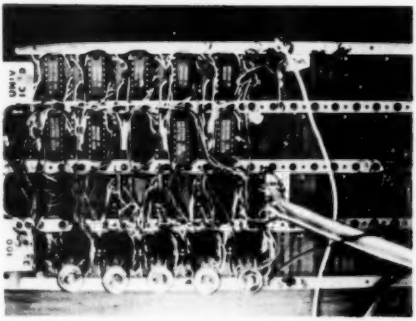


Fig. 7. An out-of-band indicator is constructed by anding the unused N states and feeding a simple driver.

If your vfo starts from some frequency other than an even megahertz, the decoder must be designed to match. If the vfo is, say 3.9 to 4.4 MHz (as is the HX500), where 3.9 corresponds to the top of the band and 4.4 to the bottom, then the decoding is as follows: 4.399.99 to 4.300.00 is 000.00 to 099.99 kHz on the dial. Thus, 3 must be decoded as 0; 2 as 1; 1 as 2; 0 as 3; and 9 as 4. To do this the gate that decodes a 3 binary state should drive the 0 (and 5) digit line, etc. The decoding section is fairly simple since only 5 states must be decoded, compared to the 10 states decoded by the SN7441AN. Figure 6 and Table I give the *general* decoding logic for all possible binary-coded-decimal states. Considerable simplification is possible if you have a good understanding of digital logic. For instance, the schematic of my unit shows the decoding function performed by one 3-input gate equivalent, three 2-input gates, and one 1-input gate.



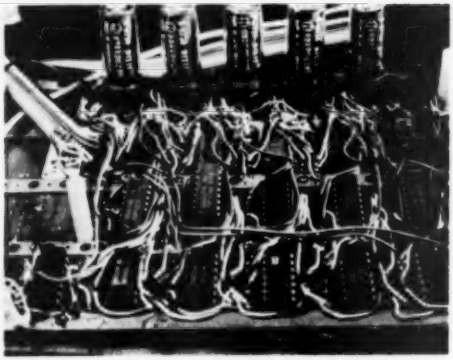
Top view of counting circuit.

If you wish, the unused states of the counter can be used to give an out-of-band indication (Fig. 7). None of the N outputs will be low if none of the proper states is decoded. This allows the transistor to be saturated. You can use it to light a light, ring a bell, disable the VOX circuit, or start a tape recording with hosannas to the FCC.

El Cheapo

Thus far, my comments have been about a "deluxe" counter with storage and 10 Hz readout. If you wish to build a more austere model (read "cheap"), there are ways to cut down on the cost. The best is to make a four-digit model with a 10 ms time base. Since the count interval is so short, you can sample once every tenth of a second, count for a hundredth of a second, perform housekeeping functions in 2.0 ms, and have a display visible for almost 90% of the time without using storage registers. One Nixie stage is eliminated, and IC6 is unnecessary.

To make the stripped-down version, substitute the circuitry of Fig. 8 for the bottom half of Fig. 2. It works as follows:



Rear view of counting circuit.

As the dividers count up from 0, the diodes decode a count of 88 and generate a 1 ms long reset pulse. At the transition to 90, the count gate decodes a binary 9 on the most significant digit and goes high for 10 ms, forming the gate interval. Thus, the SN7490s essentially perform the timing functions.

An additional Nixie stage can be eliminated by deleting the most significant digit from the count chain. This also saves the trouble of figuring out the decoding circuitry. Since any vfo will be accurate to the nearest 100 kHz, a second of mental work will compute the correct number.

Construction

Unless you want to make a PC board, the easiest way to build the unit is to use a "universal" IC card. The ICs and the Nixies can be mounted on it, and no drilling is required. Since most of the wiring is repetitive, it can be accomplished quite rapidly. The counter board will take about 4 hours, the timing board about 2. Looking at the photographs you may disbelieve me, but it goes very fast.

One suggestion to speed things up is to use the wire that can be found in multiconductor telephone cable. A four foot scrap of this stuff has 200 ft of hookup wire in it, and the wire has a soft plastic insulation which is very easy to strip. It melts at a low temperature, but since you're using a low power soldering iron, there should be no problem.

The crystal oscillator is quite stable, but it can obviously be improved by installing the crystal in an oven. The TTL circuits used in this project are much better than RTL with regard to noise immunity. A significant amount of rf can be floating around before erratic operation occurs. However, it is recommended that the unit be carefully bypassed and shielded; first, because often there *is* a considerable amount of rf floating around, and, secondly, because the pulses in the digital circuitry are very fast and can radiate noise to the receiver.

Mechanically, my unit was constructed on two boards which were then sandwiched together. This saved about 10 sq in. There is no reason why the unit can't be built on one board. Final dimensions exclusive of case were 5 by 4-1/2 by 2-1/4 in. Something this size could probably be installed inside the cabinet of the rig. If you wish, the Nixies and their drivers can be placed on a separate board which should easily fit in the space taken by the typical dial drum or scale assembly.

The unit requires 5V and some convenient high voltage. I described the B+ "supply" earlier. The 5V supply is worth a few words. Regulation is not critical, but if the supply has lots of hum or noise, filter it

TABLE I.

Connection Chart for all Binary Combinations

		CONNECT			
N=	BINARY	A	B	C	D
0	0000	$\overline{2^0}$	$\overline{2^1}$	$\overline{2^2}$	$\overline{2^3}$
1	1000	2^0	$\overline{2^1}$	$\overline{2^2}$	$\overline{2^3}$
2	0100	$\overline{2^0}$	2^1	$\overline{2^2}$	$\overline{2^3}$
3	1100	2^0	2^1	$\overline{2^2}$	$\overline{2^3}$
4	0010	$\overline{2^0}$	$\overline{2^1}$	2^2	$\overline{2^3}$
5	1010	2^0	$\overline{2^1}$	2^2	$\overline{2^3}$
6	0110	$\overline{2^0}$	2^1	2^2	$\overline{2^3}$
7	1110	2^0	2^1	2^2	$\overline{2^3}$
8	0001	$\overline{2^0}$	$\overline{2^1}$	$\overline{2^2}$	2^3
9	1001	2^0	$\overline{2^1}$	$\overline{2^2}$	2^3

out before it gets to the oscillator. The oscillator only takes 5 mA or so and an RC filter should be sufficient.

I used some nondescript power transistor for the series regulator. Anything that can handle an amp and 5W of dissipation should be sufficient.

The resistor shown bridging the transistor bypasses some of the current without, theoretically, greatly affecting the regulation. Measure the voltage across the transistor – there should be a large ac component. Pick a value for the resistor so that when the voltage is at an instantaneous minimum, the current through the resistor is about 100 mA. If all this is too much trouble, don't bother. Almost any transistor you choose can handle the power even without the resistor.

Final Thoughts

I have described a fairly simple and relatively cheap way of obtaining accurate frequency calibration. There are some inherent limitations. The main limitation is that the counter doesn't actually measure the transmitter output frequency. Since the assorted conversion oscillators are inevitably crystal-controlled, there is little cause to worry about significant errors. When you install the unit, it might be a good idea to set the vfo at 000.00 and zero-beat the transmitter output with your calibrator by adjusting the trimmer capacitors on the conversion crystals.

If you can't build the counter described because your rig doesn't fit the criteria, there is still hope. For instance, if it is additive and subtractive, you might consider using the bidirectional counters that are now available. Direction of count can be controlled by the band switch. These units are presently more expensive than the 7490s.

If your rig uses some odd vfo frequency, perhaps with a 455 kHz added or subtracted, you can try several things. One is to mix the vfo with a signal that will subtract the odd number. Another is to preset the counter with the reciprocal of the odd number and set to 9 all digits more significant than the odd number. I don't know how well these ideas will work, since it was not necessary to try them, but they seem to be theoretically sound. The reference gives a design for a more elaborate counter that might solve your problem.

If you feel as I do, that electronic equipment should have uses comprehensible to the layman, witness an additional characteristic of the digital dial. Take vfo knob firmly in hand and give it a spin. The last two digits of the display will be random numbers! Not wishing to become an accessory before the fact, I won't attempt to suggest what you might use those random numbers for, except perhaps compiling a random number table. But that shouldn't stop you from thinking . . .

...WA2IKL■

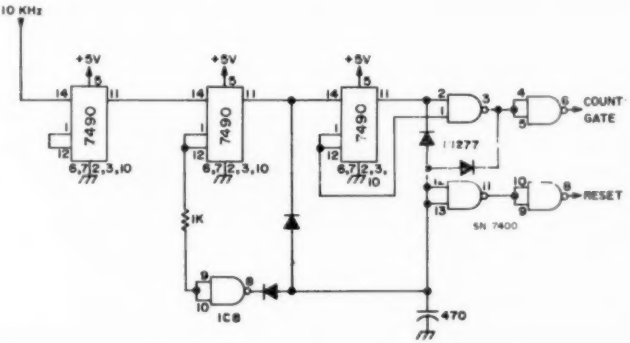
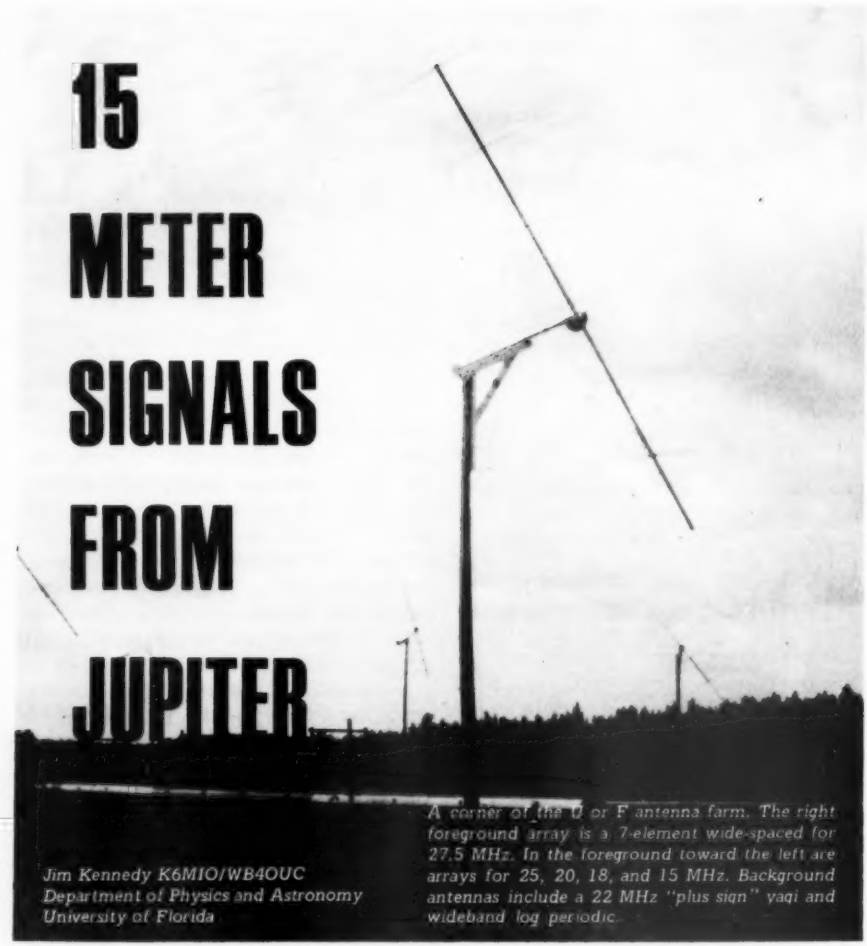


Fig. 8. By substituting this circuit for the bottom half of Fig. 2, a cheaper but less accurate digital counter results.

Ref. Macleish, Kenneth, "A Frequency Counter For the Amateur Station," QST, October 1970, pp.15.

15 METER SIGNALS FROM JUPITER



A corner of the G or F antenna farm. The right foreground array is a 7-element wide-spaced for 27.5 MHz. In the foreground toward the left are arrays for 25, 20, 18, and 15 MHz. Background antennas include a 22 MHz "plus sign" yagi and wideband log periodic.

Jim Kennedy K6MIO/WB4OUC
Department of Physics and Astronomy
University of Florida

At a time when the words "radio astronomy" conjure up pictures of gigantic parabolics and complex UHF feeds, it is a curious fact that one of the longest standing unsolved riddles in this field is commonly studied with a simple HF yagi.

The story of this puzzle begins in 1955 when two astronomers, K. L. Franklin and Bernard Burke, were testing a new 22 MHz radio telescope. Quite unexpectedly, they discovered that powerful sporadic radio emissions were being received from the vicinity of the planet Jupiter.

Jupiter is the largest of the planets in our solar system. This giant has a diameter of more than 12 times that of the earth and it is so massive that it is believed by some astrophysicists that it just missed becoming a true *star*. Its surface is shrouded by layers of clouds beyond which lie some 12 known moons. The four largest of these moons are bright enough to be seen with a good pair of binoculars. In fact, they were discovered by Galileo the first time he turned his primitive telescope on this bright object.

In the years since the initial discovery of these radio signals, investigations have led to a number of interesting discoveries.

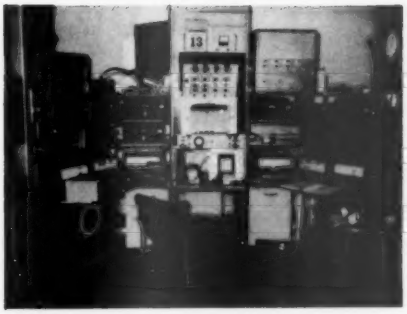
Among these are that the emissions are essentially confined to a region below 30 MHz. That is, to the region covered by most conventional communications receivers.

The energy contained in these bursts of activity is so enormous that they can be readily received by a three-element yagi and a conventional receiver.

The bandwidth of these signals is relatively narrow, sometimes no wider than 300 kHz. Such an effect definitely suggests some kind of resonance effect is associated with the generation of these signals. When observed, these signals may appear on one frequency and then gradually drift in frequency either up or down for several megahertz and then disappear.

It seems positively established that the lower the frequency, the greater are both the signal strength and the probability of occurrence.

When heard with an AM detector the Jupiter or "Jovian" signals sound very much like an unmodulated carrier being swished back and forth across the frequency. Interspersed with the swishes are shorter pops. The swishes, which last on the order of a second or so, are sometimes



Main operating position at the U of F Jupiter radio observatory. Note the 75S-1s.

called L (for "long") bursts. The L bursts, as shown in Fig. 1, are thought to be produced by scintillation or "twinkling" of even longer pulses. This twinkling is caused by the clouds of electrons that flow out from the sun and into the space between the earth and Jupiter through which the signals travel.

The pops are often called S (for "short") bursts. These appear to be caused by some mechanism at the source and their explanation may well be an important clue to the cause of Jovian emissions.

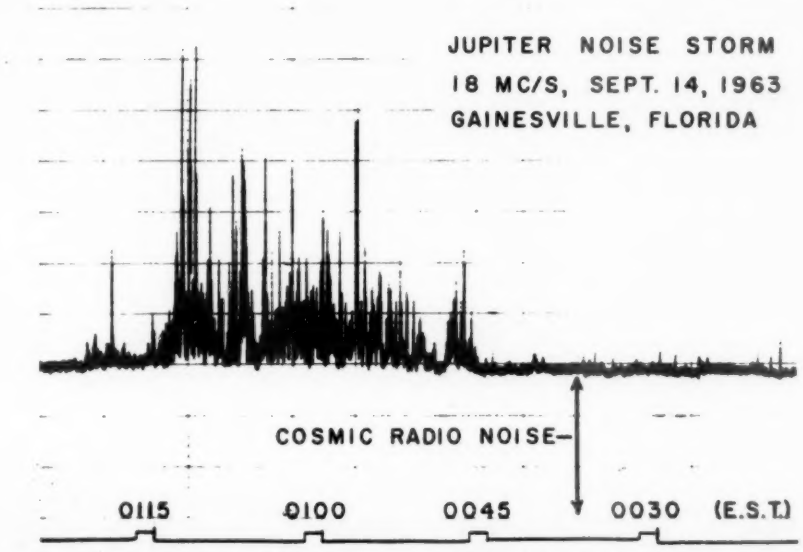


Fig. 1. Typical pen-recorder tracings of Jovian signals.

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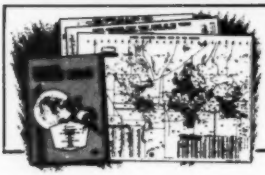

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Directional Beams

Another most curious effect is that the signals seem to be directional in nature. That is, it appears as if the radiation is confined to beams about 70° wide and originate from specific confined areas of the planet. Observations indicate that the emissions observed are originating from no more than three or perhaps four locations which rotate with the giant planet. Radiation is detected only when those regions of the planet face the earth. Measurements made by two different techniques suggest that the source size has an *upper limit* of 400 km, and may be as small as 3 km.

Narrow bandwidth, directional beams, and fixed localized and limited sources quite naturally lead to the speculation that the signals may be the result of some "intelligent" activity. However, partial explanations for these effects, based on *natural* occurrences, exist and it seems probable that further investigation will, in time, complete this picture.

Figure 2 shows a diagram of storm occurrences as a function of longitude for the rotating planet. It will be noted that three or perhaps four distinct sources, labeled A, B, and C are present.

The explanation of the discrete source locations may lie in the supposed existence of short variations or "glitches" in the planet's magnetic field. Such anomalies are known to exist in the earth's field and can be supposed to exist on Jupiter.

Such glitches would be fixed in the planet's field and rotate with the planet.

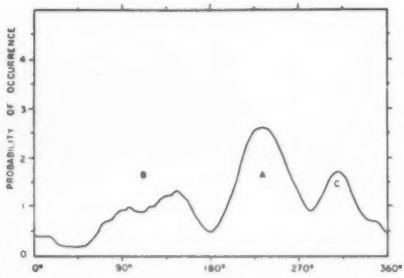
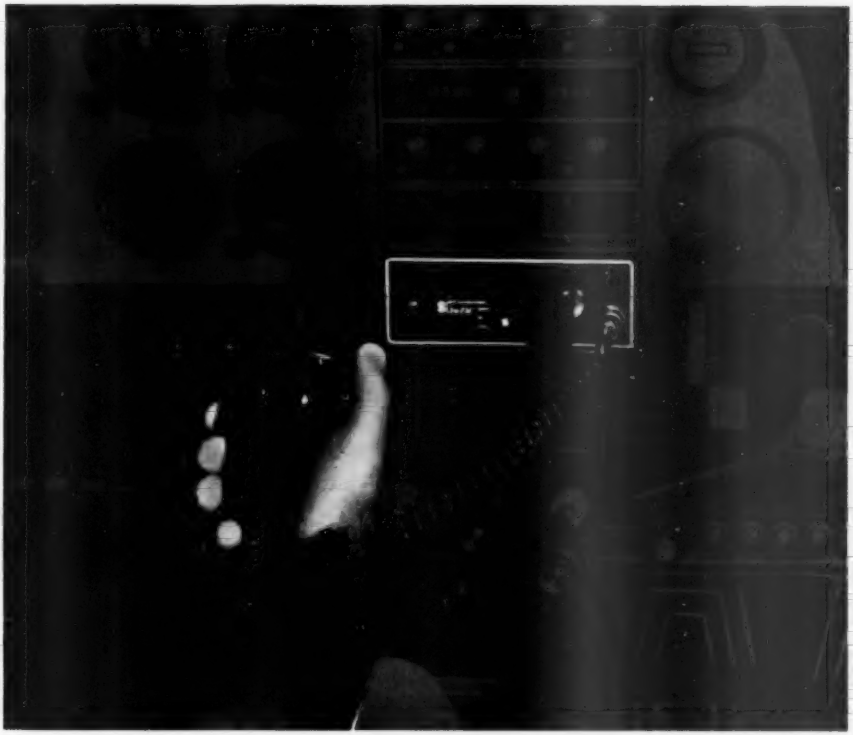


Fig. 2. A plot of the probability of noise storm occurrence versus Jovian longitude illustrating sources A, B, and C distributed around the planet.



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They could provide a collecting place for electrons at some level in the magnetosphere and perhaps provide a site at which some mechanism would excite these electrons into oscillation.

Another more recent explanation suggests that the sources are caused by fast electrons following the magnetic field lines into the upper atmosphere near the north and south poles. These electrons would radiate in cone-shaped beams. Due to the fact that the magnetic poles of Jupiter are inclined some 10° to its rotation axis. This combination leads to the beams only being aimed at the earth during times of Jupiter's 10-hour day. This gives rise to the appearance of several sources while there may be as few as two. In a general way this process bears some similarity to that which produces *aurora* here on earth. No matter which of the many explanations is correct, the combination of electrons and magnetic field would provide the necessary (gyromagnetic or synchroton) resonance effect for the narrow bandwidth emissions, but not necessarily the *energy* to produce oscillation.

Just what source of driving energy does produce the oscillations? In the beginning it was thought that the radiation may have been caused by lightning strikes on the planet. However, measurements of the energy received here on earth indicate that the energy of the Jupiter "noise storm" bursts is approximately 10^{11} times that of an earthly lightning bolt! Hence this explanation seems *inadequate*.

The Io Effect

Adding to the confusion about the source mechanism is the more recently discovered Io effect. Io is the innermost of the four large satellites discovered by Galileo and is slightly smaller than our own moon.

It has been found that a significant number of the noise storms occur when Io is in certain preferred positions with respect to the various source locations. Hence, while storms *may* occur at any time one of the sources faces the earth, somehow Io enhances the probability of a storm considerably. Figure 3 illustrates that when

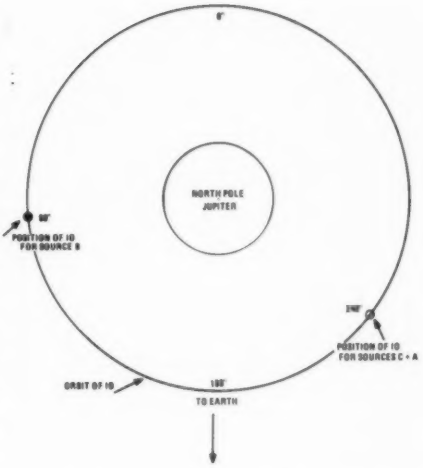

Fig. 3. This illustration shows the positions of Io which appear to trigger source B and source C and A storms.

Io is at a position of 90° from directly behind Jupiter, source B is most likely to produce storms. In fact, as high as 98% of all source B storms occur when Io is near this location. Likewise, when Io is at an angle of 240° source C and sometimes source A are likely to be active. Of course, not only must Io be in one of these "special" positions, but simultaneously, the appropriate source must be aimed at the earth.

One theory, called the "dynamo hypothesis," holds that this moon, oribiting well within the strong magnetosphere at about 280,000 miles, conducts electricity well enough to interact with the rotating magnetic field of the planet to form a giant electrical generator. If this were so, in certain positions it could pump the large numbers of energetic electrons along the magnetic lines into the polar zones to cause the noise storms.

A full understanding of how this comes about will undoubtedly aid significantly in solving the basic problem of why the storms occur at all. In the meantime the Io effect provides a convenient way of actually producing fairly accurate predictions of when noise storms will occur.

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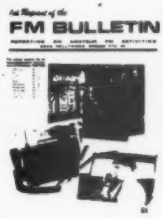

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Receiving the Noise Storms

Receiving signals from beyond our own ionosphere presents problems of its own. The same electrons that reflect 21 MHz signals back to earth and provide skip, also reflect away incoming signals from beyond. Consequently one must observe at times when the ionosphere is "transparent." This is to say, one must, in general, listen at night.

This all adds somewhat to the complexity of things since it requires that Jupiter be *up* at night. Therefore, it is only possible to listen for Jovian signals for about six to eight months of the year. The 1970–1971 "apparition" began about December 1970 and will end about July 1971.

Receiving these storms is well within the capabilities of any amateur who has three or more elements on 15 meters. This, in combination with any decent communications receiver will produce excellent results.

The only difficulty is that most tribanders do not point up (except perhaps after a high wind!). Depending on the time of night Jupiter may be found as high as 40° or so above the horizon. Two general solutions exist for this problem. One approach would be to arrange to tilt the antenna. This can often be done with a small yagi by modifying the mounting bracket and using a simple system of ropes to tilt the antenna, while using the rotator, as before, to change the azimuth. (It might be added that such "haywire" systems are still used occasionally by "professionals" today.)

The second solution is to do *nothing* All earthbound horizon-aimed antennas have at least one, usually many lobes aimed high in the sky, due to ground reflection. Hence, if the antenna is pointed at the same azimuth as Jupiter, there is a fair chance that half the time Jupiter will be in one of these lobes. Needless to say, however, the former system is more certain than the latter.

While Jupiter does not radiate at 21 MHz continuously, the Io effect permits fairly good predictions to be made.

Since some storms occur without correlation to the Io effect, it is also possible to observe Jovian activity on other than the predicted nights.

One should be careful not to confuse lightning discharges with Jupiter. The raspy crash of lightning is quite different than the rounded swishing of Jovian signals. Those living in areas of high electrical activity (such as here in Florida) will hear a good deal more lightning than Jupiter. Likewise, in the early evening or toward sunrise, those within skip distance of such an area may also experience activity of this sort. Occasionally, if sporadic E is present, skipped lightning may occur at any time of night.

Despite the very great similarity between Jovian signals and that of a carrier being swished across the frequency (when you use an *AM* detector), this is only an illusion. If you use a product detector, do *not* expect to hear a carrier going back and forth through zero beat. Both cases will yield only a strong rise in the noise that *sounds* like a carrier on an AM detector.

The interested reader who wishes to pursue the matter of theory and previous observations further will find, in Radio Exploration of the Planetary System,[1] an interesting and very readable account of the Jupiter story. At a somewhat higher level, the article "The Magnetosphere of Jupiter,"[2] available through most college libraries, provides an up-to-date review of current work.

The author wishes to thank Drs. Alex Smith and George Lebo and their associates at the University of Florida for providing the data in Figs. 1 and 2.

. . .K6MIO/WB4OUC■

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1. A. G. Smith and T. D. Carr, 1964, *Radio Exploration of the Planetary System*, (D. Van Nostrand Company, Inc., Princeton, N.J.).
2. T. D. Carr and S. Gulkis, 1969, *Ann Rev. Astron. and Astrophys*, v. 7.

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Part XI Antennas

One item which every radio station, be it for two-way communications or merely a listening post, has in common is the antenna. By definition, the antenna is the part of an installation which couples the transmitter or receiver to that little-understood medium in which radio signals travel, so without one neither transmission nor reception could be possible.

Because of its central importance, the antenna is involved in a number of questions in the FCC examination for the General class ticket. Let's look at some of these questions dealing with antennas and closely related subjects.

The FCC study list questions include:

13. Define standing wave ratio (swr). How can the swr of a line be determined? How are the swr of a line and its characteristic impedance related? Name some factors that affect the characteristic impedance of an air-insulated parallel-conductor transmission line?

21. List several characteristics of a vertical quarter-wavelength antenna.

41. How is the approximate length of a half-wave dipole related to the resonant frequency? Compare the operating characteristics of a half-wave dipole and a grounded antenna.

43. How can amateur equipment be protected from lightning discharge?

49. Briefly discuss how a multiband "trap" antenna operates.

Since these questions cover not only antenna operation and characteristics, but those of antenna feedlines as well, we're going to have to look at everything between the transmitter output connector and the input connector of the distant receiver to get a full grasp of them.

We'll begin by trying to determine "How do antennas operate?" If we get around that one (and several very thick books have been written on the subject; hopefully, we'll take far fewer words and not leave you nearly so confused), we'll continue by asking, "What major kinds of antennas exist?"

From there, we'll shift our attention to the feedline and inquire "What's impedance in antennas and feedlines?" Finally, we'll get around to that perennial conversation-piece swr with our last question, "What does swr do for you?"

It's a big assignment. Let's get moving.

How Do Antennas Operate?

In the beginning of this study course we made the acquaintance of the electric and magnetic fields which are inseparably associated with the flow of electrical current or the motion of a magnetized object. At that time, we observed that while the electric and magnetic fields were alternately swapping their energy content to provide motion of the current, some of the energy was lost to the mysterious surrounding medium, and this loss was known as "radiation."

An antenna is simply a device intended to make this "loss" of electromagnetic energy easy; its whole purpose is to couple energy from a normal wire conductor into space, or from space back into a normal conductor.

Since any flow of current within a conductor involves at least some radiation, almost any conducting material must act as an antenna of sorts, coupling energy into space and vice versa. That's why portable radios operate so well with self-contained

antennas. They have high sensitivity, and the tiny internal antennas extract enough energy from the powerful broadcast station signals to do a good enough job.

Virtually all ham antennas, though, are conducting surfaces which are large in comparison with the wavelength involved. When the conductor is long in comparison to the wavelength, the field strength at any one point on it will not be balanced out by similar strengths at many other nearby points. Instead, the strength of both the electric and the magnetic field around any one point on the conductor will vary, and the strength from one point to another will vary depending upon the distance between the points.

To see how this works, let's look first at a half-wave dipole antenna which is fed at its center. This antenna (Fig. 11-1) is one of the most commonly used varieties, and is also one of the easiest to visualize in operation.

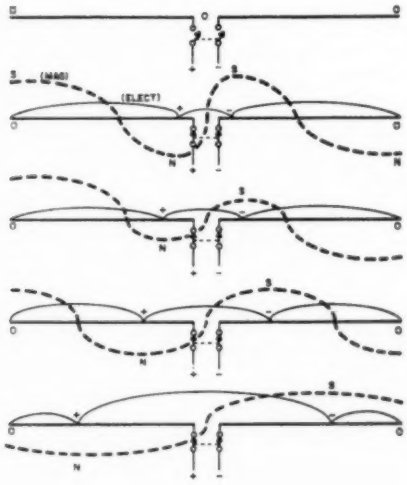

Fig. 11-1. Half-wave dipole provides example of how resonant antenna operates. At top antenna is disconnected from any energy source and so is inactive. When energy is supplied, fields begin to travel toward tips of antenna. As they travel, radio waves are emitted into space. Each cycle of RF repeats this action to provide continuous radiation.

First, let's assume that we have neither voltage nor current associated with the antenna. With no voltage, there's no electric field, and without current, no magnetic field. The antenna is just so much wire, hanging in the breeze.

Now let's apply a voltage suddenly at the feedpoint, say 100V between the wires. That would be +50V to one wire and -50V to the other, for instance.

These voltages cannot appear instantly at the ends. Instead, they must travel along the wire (at approximately the speed of light) to get there.

At each instant during this rather brief trip, there's a point on one wire at which voltage is just changing from 0 to +50V, and a corresponding point on the other at which it's just going from 0 to -50V. As the "wavefront" moves toward the ends of the antenna, these two points are getting farther apart from each other.

Since these two points are at different voltages, an electric field will exist between them. And since they're moving away from each other, the field is expanding rapidly. The energy which enables this field to expand is extracted from that which we fed into the wires to cause the initial change.

But whenever an electric field moves, a magnetic field moves right along with it. That voltage change involved a current flow, and the current flow is greatest back at the feedpoint because that's where all the energy must pass.

Eventually (rather rapidly, in fact) the voltage change reaches the ends of the antennas. Now it has no place to go. The field, however, is expanded to a large region, and contains a surprisingly large amount of stored energy which has to go someplace.

When the voltage stops moving, the current through the feedpoint stops also. The associated magnetic field collapses (because motion stopped). Thus, when the electric field is at its strongest, the magnetic field is at zero, which establishes a 90-degree-out-of-phase relationship between the fields and imparts outward motion to the resulting radio wave.

When the magnetic field collapses, nothing remains to hold the electric field stretched, and it also collapses. The voltages rush back down the elements toward the feedpoint. Since they're now going the other direction, their polarities are reversed, and when they get back to the feedpoint the electric field is back to zero while the magnetic field is at maximum.

If we do this with dc, as we did in this example, everything will stabilize after a few such cycles. The fields will carry away any transient energy, and when the full length of the antenna reaches a steady state, radiation will cease.

However, if instead of dc at the feedpoint, we apply ac, and adjust the frequency of this ac so that each time a reflected wavefront comes back from the tips of the antenna elements, it finds a new "push" just ready for it to send it on its outward path again, then we have a radiating device par excellence. It will accept just enough energy from the feedpoint to balance out that which it "loses" to space, and thus maintain what is known as a "standing wave" of rf energy on the antenna. During each cycle of applied rf, this standing wave will launch an infinite number of traveling radio waves into space.

In practice, we cannot adjust the frequency to suit our antenna, because ham frequencies are assigned within relatively narrow bands by the FCC. What we do instead is to adjust our antenna length to fit the frequency at which we desire to operate.

Frequency and wavelength are closely related, since frequency is the number of complete cycles which occur in a specified period of time, and wavelength is the distance between corresponding points of two successive cycles. The speed at which radiation travels is the relating element; wavelength is equal to speed of travel divided by frequency. If wavelength is in meters and frequency in megahertz, the formula comes out to be $\lambda = 300/f$.

The half-wave antenna we've been using as an example, then, should have a length approximately half of one wavelength. To operate at 7 MHz, its length should be about 22½ meters.

This relationship is only approximate, though, because every antenna has some capacitance to ground, which makes it appear to be a little longer (to the fields) than it really is. The difference usually amounts to about 5%; the formula usually used to determine length of a "half-wave" antenna takes this into account, and also comes out in feet rather than meters. It's: length = 468/f, where f is frequency in MHz.

Figure 11-2 shows what happens when an antenna is either too short or too long for the operating frequency, as well as the desired result when the length and frequency match.

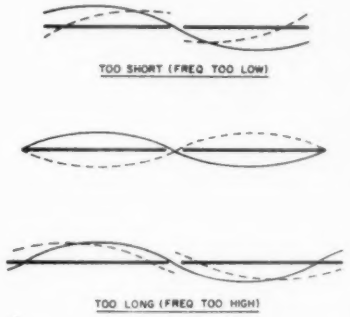

Fig. 11-2. When antenna is too short for operating frequency, reflected electric field is out of phase with driving energy (top) and part of driving energy is cancelled. If antenna is too long for frequency (bottom), same thing happens in reversed phase. Only if antenna length and operating frequency match (center) does all energy radiate, and antenna's impedance has no reactive component.

However, one-half wavelength is not the only practical length for antennas. Almost any multiple of quarter-wavelengths (with the 5% correction factor applied to the one at the far end, only) can be used. Such antennas are sometimes called "long-wire" antennas, although some hams use the term "long wire" for a random-length antenna which operates in spite of rather than because of its length.

Any antenna has two characteristics by which its performance can be measured, and a third which is essential to making use

of it. The "rating" characteristics are its directional pattern or *directivity*, and its *efficiency*, and the third characteristic is its *impedance*. We'll examine impedance later. Right now let's take up directivity.

When the antenna launches its radio waves into space, each tiny part of the conductor launches its own collection of rays. That is, each infinitesimal portion of the antenna acts like a tiny isolated antenna, and each radiates its energy equally in all directions like an expanding sphere.

In some directions, however, the traveling waves from various parts of the overall antenna structure has phase relationships which cause them to cancel each other, while in other directions these phase relationships cause the individual rays to reinforce each other and build up added strength.

For the half-wave dipole, the resulitng pattern of "far-field signal intensity" is something like a donut strung on the antenna wire (Fig. 11-3), with the strongest part of the pattern at right angles to the wire itself, and no field strength at all off either end.

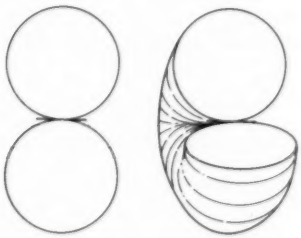

Fig. 11-3. Radiation pattern of half-wave dipole is shown here both in cross-section (left) as generally drawn in pattern diagrams, and three-dimensionally (right). Resemblance to donut strung on wire is easy to see. This pattern occurs only if antenna is in "free space" with nothing affecting it, a condition which never actually occurs. Actual antennas are influenced by presence of ground, which reflects energy and modifies the radiation patterns.

Long wires modify this pattern to produce a cone of field strength (Fig. 11-4), aimed in the same general direction as the wire is pointing, but covering a region at an angle to the wire itself.

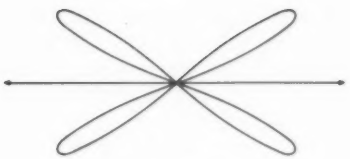

Fig. 11-4. Long-wire antenna's radiation pattern stretches the figure-8 pattern of dipole into pair of lobes. The longer the wire, the closer the lobes approach the wire direction. In 3 dimensions, pattern would resemble two cones, point-to-point, strung on wire.

Combinations of long wires can be put together as in the rhombic antenna (Fig. 11-5), to give almost no response at all except in the two directions in which all the combinations add together. Such antennas are favorites of commercial installations, as well as of those hams who can afford enough space to string them. Most of us, though, must settle for much less.

In fact, the differences between the various types of antennas are largely differences in directional patterns, or in different types of construction in order to achieve equivalent directional patterns.

The efficiency of an antenna is difficult to measure. In general, resonant antennas (those which are multiples of quarter wavelengths long) have the highest absolute efficiency, and directive antennas (those

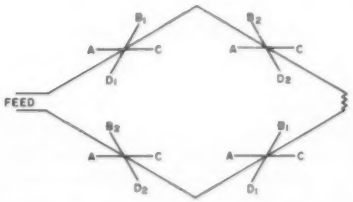

Fig. 11-5. Rhombic antenna is derived from long-wire (Fig. 11-4). Each leg of the rhombic has a long-wire pattern symbolized here by lines rather than lobes. Radiation arriving from left, however, goes to terminating resistor and does not affect feedline; thus lobes A, B2, and D1 have no effect on antenna operation. That arriving from right can reach feedline. Of this, only that in lobe C of each leg adds up. B1 lobes tend to cancel each other out, as do D2 lobes. Result is highly directional single-lobe pattern, but antenna is too large for most ham installations.

with sharp directional patterns which concentrate the radiated energy within relatively small volumes of space) have higher apparent efficiency than do nondirectional antennas. One rule of thumb left over from the earliest days still is surprisingly valid – the more wire, the better.

In addition to the characteristics of directivity, efficiency, and impedance, which we've mentioned, every antenna has one other characteristic called *polarization*.

While it's a bit hard to visualize clearly, every radio wave is composed of two related fields in motion – the *electric* field and the *magnetic* field. Each of these fields has its own plane, and the two planes cross each other at right angles to establish the line along which the wave travels. If it helps to think of the two walls of a room meeting at the corner to establish the position of the corner, do so.

The polarization of this radio wave is simply the direction in which the electric field's plane extends. If the electric-field plane is vertical, the wave is said to be vertically polarized, and if the electric-field plane is horizontal, the wave is horizontally polarized.

Since it's impossible to separate out a single radio wave in practice, a "vertical" or "horizontal" polarization of a signal must refer to the polarization of the majority of the individual waves which make up that signal. As a result, all actual signals contain portions of both polarizations. A "vertical" signal will have some horizontal components, and vice versa.

A signal which contains both vertical and horizontal components is known as an "elliptically" polarized signal, and if it has equal amounts of vertical and horizontal, we call it "circular" polarization.

What determines the polarization of a signal is the antenna that transmits it – but polarization of any individual wave will change every time that wave is reflected from anything on its path from transmitter to receiver.

The plane in which the transmitting antenna polarizes the signal is the same as that containing the wire of the antenna, for the most common antenna types. Thus, a horizontally stretched half-wave dipole will

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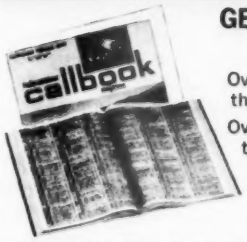

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transmit a horizontally polarized signal, while a vertical antenna will transmit a signal having vertical polarization.

If the signal is transmitted at the same time from two antennas, one vertical and one horizontal, the result is an elliptically polarized signal.

In the normal HF region (3 to 30 MHz), the polarization of the signal doesn't mean too much because most communications in these bands are by means of the ionized layers of the atmosphere, and the polarization is rotated when the signal reflects from these layers. At VHF, however, polarization is important. VHF work in this country now seems to be about equally divided between vertical and horizontal polarization. Elliptical polarization is seldom used except in the UHF regions and above, where the helical antennas which produce it most simply are small enough to be convenient.

Now that we have some ideas about how an antenna works in general, let's take a look at the various types of antennas in common use.

What Major Kinds of Antennas Exist?

Antennas are classified in many different ways. Some of them are named for the people who first popularized them, some are named for their major characteristics, and some have apparently arbitrary names.

The most general division of antennas breaks them into two groups: those which depend upon standing waves for their operation (as described in the previous section) and those which operate with traveling waves. Traveling-wave antennas are sometimes known as "terminated" antennas. Hams make very little use of this type, because at moderate frequencies they require excessive acreage, and at frequencies where their size is practical, they are outperformed by other types. The rhombic is virtually the only terminated antenna used by hams, and we won't go into any of the others in this group.

The antennas using standing waves can be subdivided again into those which are "resonant" and those which are not. A resonant antenna is one which is cut to a length which is a multiple of ¼ wavelength, or made to appear to be such a length by electrical tricks such as loading coils, capacitance, or tuned traps. Most ham antennas are resonant.

A nonresonant antenna is simply a random length of wire. Normally such an antenna does not operate well unless it's tuned by an antenna tuner, which turns it into a resonant antenna so far as the electrical properties are concerned.

Among resonant standing-wave antennas, though, there are still an amazing number of types to be examined.

The most common is the half-wave dipole which we used to examine antenna operation. In its purest form, this consists of a length of wire one-half wavelength from end to end (less the correction factor we mentioned before, for end capacitance), with an insulator in the middle. This divides the antenna, both physically and electrically, into two equal quarter wavelengths of wire set end to end. These are fed with a "balanced signal" (one which is balanced with respect to ground, so that when the signal on one wire is at its positive peak that on the other is at negative peak).

The dipole continues to be a good performer even when its two wires are not stretched in a straight line. Such variants have many names.

For instance, the popular "inverted vee" antenna is merely a half-wave dipole suspended from a single pole at the center, with the ends allowed to droop down to much shorter supports. Its behavior is much the same as that of the dipole.

A half-wave dipole performs well not only at its fundamental frequency but at the third harmonic of this frequency, where each wire is ¾ wave long instead of ¼ wave. That is, a dipole cut for 7 MHz also does well at 21 MHz.

However, at even harmonics the dipole does not do so well. The feedpoint impedance becomes high rather than low (voltage fed rather than current fed). And most ham bands are in an even-harmonic relation to each other.

Operators who want to use all bands thus find themselves in need of several

antennas if they intend to use the dipole. One solution to the problem which finds wide use is to place all the antennas together (Fig. 11-6). This is sometimes called a "parallel dipole" antenna. Only the pair of conductors which are resonant at the particular frequency in use are effective, and they operate as a half-wave dipole. The rest of the conductors merely go along for the ride.

Fig. 11-6. Parallel-dipole antenna consists of several half-wave dipoles all strung together and connected at feedpoint. Only that which is resonant in any band is effective; rest disconnect themselves.

Another solution to the problem is the "trap" antenna. This is essentially a half-wave dipole for the lowest frequency to be used, with tuned parallel-resonant "traps" inserted in the wires. At the lowest frequency, the trap circuits show up as inductance which electrically lengthens the wire, so that the physical length of the antenna is less than its electrical length. At the next higher band, the outermost traps are resonant and effectively disconnect the ends of the wire, leaving a half-wave dipole for the higher frequency. In a 5-band trap antenna (Fig. 11-7), this dipole also is loaded by the inner traps.

At the next higher band, the next set of traps is resonant and so cuts off all the ends (including the outer traps). The fourth band of the 5-band trap is 21 MHz, which takes advantage of the third-harmonic operation and uses the 7 MHz dipole. Finally at the highest band, the innermost traps isolate the outer portions of the antenna to again produce a half-wave dipole.

Fig. 11-7. Trap dipole makes use of parallel-resonant "trap" circuits in wire to alter length of antenna depending upon frequency. See text for explanation of antenna's action.

The trap antenna is a bit more difficult to adjust properly than is the parallel dipole, because the wire length, trap inductance, and trap capacitance all interact with each other at every operating frequency. However, these multiple interactions permit fine adjustments which permit improved performance if you have enough patience.

Still another solution to the all-band antenna situation is the Windom antenna. The Windom is a pseudo-balanced antenna similar in appearance to a half-wave dipole, but with the two conductors being of unequal length. This raises the feedpoint impedance to approximately 300Ω, permitting use of common TV twinlead. Interaction between the shorter wire and the longer wire permits resonance on several ham bands simultaneously.

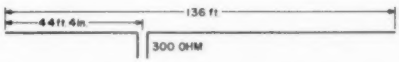

Fig. 11-8. "Windom" antenna provides match for 300Ω feedline and has been popular since mid-1930's. Dimensions are critical in order to approximate 300Ω impedance at feedpoint on all hf ham bands.

The "L" antenna is similar to the Windom, but the two legs of the antenna extend at right angle to each other rather than in a straight line. This tends to broaden the directional pattern in comparison to the two-lobed effect common to almost all dipoles.

All of the antennas we've examined so far have been of the "balanced" variety, which are normally stretched in the horizontal plane and so produce horizontally polarized signals (they don't have to be; at higher frequencies vertical dipoles are often used).

However, radio waves will reflect from any conducting surface, and the reflection produces the same effect as a mirror does for light rays. That is, if a half-wave dipole were to be cut in two at its midpoint and a

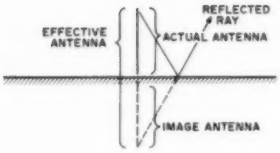

Fig. 11-9. "Image" principle is key to operation of quarter-wave vertical antenna. Reflected ray shown actually originates at tip of actual antenna, but apparently originates at tip of "image" antenna beneath ground surface. Effectively, then, antenna is a half-wave dipole standing on end, while actual structure is only quarter-wave high.

huge reflector properly placed (Fig. 11-9), the effect would be the same as if the other half of the dipole (the "image" antenna) were actually still present.

This is the basis for the quarter-wave grounded antennas often known as "Marconi" antennas. They are, in effect, half of a half-wave dipole, using the ground as the reflector to provide the "image" of the rest of the antenna.

Such an antenna must be vertical in order to use the ground as the reflector, and so this type of antenna is often called simply the "vertical" antenna.

Traps can be used in a vertical, for the same effects obtained in a trap dipole. Similarly, several verticals can be erected in parallel with each other and sharing a common feedpoint to produce an all-band vertical operating much like the parallel dipole.

The major differences between the vertical and the dipole stem from the different orientation. Where the directional pattern of the dipole (on the earth's surface) has two lobes of major response, with nulls off the ends of the wire, the vertical is omnidirectional. Its single null is off the end of the wire still, but now that points straight up. The three-dimensional directional pattern is still the same, but since it intersects the earth's surface differently, the practical effects are greatly changed.

The second major difference comes from the change from balanced (two-wire) to unbalanced (one wire against ground) operation. This changes the feedpoint impedance and the type of feedline required.

It may seem as if we've omitted several common antenna types from this listing. For instance, we have not yet mentioned the folded dipole or the monopole. However, while these are often spoken of as if they were distinct antenna types, they are in fact only variations of other types which we have already described, which have different impedances. We'll get to them in the next section.

So far we've discussed only the simpler types of antennas. Long ago people found that the directional properties of an antenna could be modified by adding more antennas to it, forming an antenna array. The added antennas can be parallel to the original but separated by some fraction of a wavelength (broadside array), in a straight line with the original (collinear array), or a combination of these (Franklin array). The directivity can be controlled by proper phasing of currents in the individual elements of the array, to give broadside or end-fire patterns, or to vary the direction of maximum response (beam-steered array).

Most of the different antenna types used by hams at frequencies above 14 MHz involve some type of array. Among them are such designs as the "sterba curtain," the "ZL special," the "8JK," the "flattop," and so forth. A special group of array designs involves "parasitic" elements which are not driven by feedlines, but reradiate energy absorbed from that radiated from the driven element. The most common of these "beam" antennas is the yagi, but again many variations have been designed and each has its own name.

One of the more recent types of antenna arrays is the "log periodic" antenna, which involves exotic mathematics in its design. Such an antenna can cover a bandwidth of 10 to 1 while maintaining a good beam pattern and a low swr, but it's a bit beyond the scope of our discussion here.

When you reach the VHF bands, the number of antenna types takes another sudden jump. There you may encounter such things as the discone, the helical, or the rereflecting dish (parabolic antenna).

However, for the General class exam, it's enough to know the simpler types such as the dipole and the vertical, as well as having some idea of the different types in use. We've got enough for that now, so we'll continue and examine impedance and feedlines.

What's Impedance in Antennas and Feedlines?

Whenever you discuss antennas, you can't escape *impedance*. It's one of the major characteristics of any antenna, and of any line used to feed the antenna with energy. What we hope to do here is to clarify just what it amounts to, and why it's so important to antenna operation.

Back in one of the early chapters of this study course we made the acquaintance of impedance in its most general form, and discovered that impedance amounts to "any quantity measured in ohms" while the ohm is simply the ratio of voltage to current at any point in a circuit.

Since both voltage and current are present in an operating antenna at every point along the conductor, it's only natural that every point on an antenna should have an impedance of some type.

But because of the way in which an antenna operates, both the voltage and current are varying, and where voltage is high current is low and vice versa. Therefore the impedance must change from point to point along the antenna. Where voltage is high, so is the impedance; where voltage is low and current high, the impedance is low.

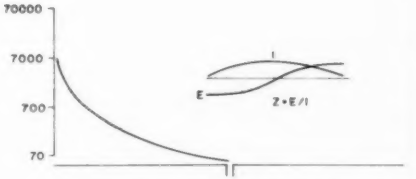

Fig. 11-10. Variation of impedance along half-wave dipole from center to ends is shown here. Impedance is ratio of voltage to current, both of which vary along antenna's length as shown in inset, and so ranges from very low at center to very high at ends. Because of radiation, impedance never reaches zero, but has minimum of about 70Ω for half-wave dipole in free space.

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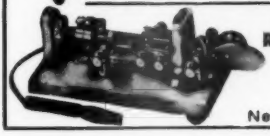
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Figure 11-10 shows how impedance varies along a half-wave dipole. At the ends, it's very high (the capacitive "end effect" which makes it necessary to shorten the wire by 5% from an actual half wavelength keeps some current flowing even at the end, and so keeps impedance from becoming infinite). In the center, it is low.

You might expect the impedance to drop to zero at the center of an ideal dipole, but it doesn't, because the antenna is radiating power and so there's always a little more power going in than there is reflecting back from the ends. In "free space" separated from all other conductors, a dipole would have an impedance of about 73Ω at its center.

Any actual antenna's impedance will be modified by the energy which it receives from nearby reflecting surfaces such as the ground. Figure 11-11 shows how the impedance of a dipole varies because of this ground effect, assuming that the ground is a perfect reflector.

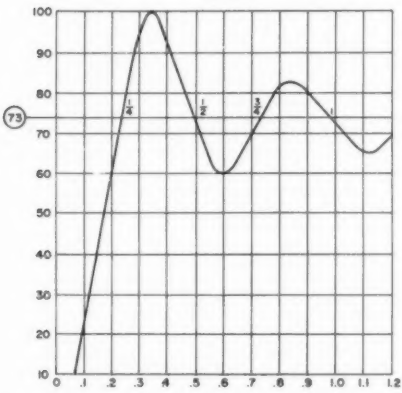

Fig. 11-11. Impedance of half-wave dipole illustrates action of reflected energy from ground in changing antenna's actual impedance. Vertical scale is impedance in ohms; horizontal is height above electrical ground in wavelengths. At multiples of one-quarter wave, conditions are similar to those of free space. At other distances, impedance may be higher or lower than anticipated value.

When several antennas are used together in an array (or when parasitic elements are placed near a driven element as in a yagi or other beam antenna), the power in each of them affects the power in each of the others – and so their impedances change.

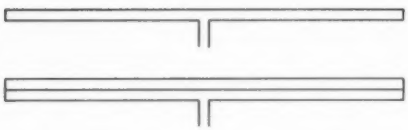

Fig. 11-12. Folded dipole multiplies antenna's impedance by providing alternate paths for current and so raising voltage-to-current ratio. Two-wire version (top) multiplies by 4; 3-wire version by 9.

Because impedance is a measure of the ratio of voltage to current, anything which modifies this ratio will change the impedance of an antenna. One of the most common modifications of this sort is the "folded dipole" antenna (Fig. 11-12). This is an ordinary half-wave dipole, with a second half-wave of wire strung alongside and connected to it at the ends. Now, when the voltage peaks reach the ends of the antenna and reflect back, they have not one but two paths available – one back down the original wire, and the other down the second wire alongside it. This splits the current between the two wires, and at the same time doubles the voltage for the same power (to keep power constant). The result is that the impedance is multipled by four, two times being for the doubling of voltage and the other two for the halving of current. A folded dipole then has about 300Ω feedpoint impedance in comparison with the ordinary dipole's 73Ω. This makes the folded dipole a nearly perfect match for 300Ω twinlead.

If the two conductors of the dipole are not of the same diameter, the current will divide according to the ratio of the diameters. If the driven half is only half as large a wire as the passive side, two-thirds of the current will flow in the driven portion assuming both halves are of the same material. To keep power constant, the voltages must change by the same ratio, so that at the feedpoint the current is one-third as great as in a plain dipole, and the voltage 3 times as large, giving an

impedance multiplication of 9 times or about 650Ω. This fact is often used in beam antennas for impedance matching, to raise the feedpoint impedance of the array up to something large enough to match conventional feedlines.

The "monopole" is simply the vertical version of the folded dipole, in which the passive conductor is grounded. It provides the same impedance-multiplying effect, for the same reasons.

What makes impedance so important in an antenna and feedline is the fact that rf energy flows smoothly only when the impedance of the circuit in which it is flowing does not change. In fact, the reason an antenna radiates is directly related to the fact that its impedance changes, as we saw earlier in this capter. So long as circuit impedance remains constant, the rf energy finds a "smooth" path to follow and like all kinds of energy, flows along the path of least resistance. When impedance changes, this produces a "hump" in the path, and energy goes in all directions. If the hump is small, most of the energy keeps going in its original direction, but some will be radiated and some will be reflected at any hump or discontinuity.

Now that we've seen what the impedance of an antenna amounts to, how about the feedline?

In general, feedlines (like antennas) can be divided into two major groups: balanced and unbalanced. 300Ω twinlead is an example of balanced feedline. Coaxial cable is an example of an unbalanced line. Just as with antennas, the "balance" is with respect to ground. In a balanced feedline, any voltage in one wire with respect to ground is "balanced out" by an equal voltage of opposite polarity in the other wire. In an unbalanced line, one conductor is always at ground potential and the other carries the full energy flow.

Most balanced feedlines are composed of two parallel conductors, and this type of line is often called parallel-conductor transmission line. It may, however, have more. In some commercial installations, four wires are used in a balanced configuration to carry higher power. 300Ω line is a parallel-conductor transmission line.

In a parallel-conductor line, the two conductors are kept a fixed distance apart by means of some type of insulating material. In the 300Ω line, the insulating material is typically polyethylene. At higher power levels, air is often the insulating medium. In an air-insulated parallel-conductor line, conductor spacing is fixed by means of insulating spreaders at regular intervals.

While both balanced and unbalanced feedlines have a "characteristic" impedance, it's easier to visualize in the case of the parallel conductor lines, and so we'll look at them first.

Whenever such a line is varying power, a voltage exists between the two conductors at all times, and current is flowing in each. Since every conductor has inductance, each of the line's two conductors will have inductance. Since the two conductors are separated by an insulating material, capacitance will exist between them. Both the inductance and the capacitance are "distributed" along the full length of the line rather than being "lumped" into separate inductors and capacitors. The inductance will restrict current flow, while the capacitance will inhibit voltage change. The net result of the inductance and capacitance is that each tiny incremental portion of the line is equivalent to the circuit shown in Fig. 11-13.

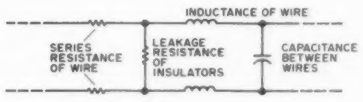

Fig. 11-13. Equivalent circuit of transmission line includes series resistance and inductance of each conductor, shunt resistance of insulators, and capacitance between wires. Inductance and capacitance here determine line's "characteristic impedance."

Since both resistance and reactance are present in this circuit, it must have some value of impedance associated with it. As it happens, the impedance turns out to be constant with frequency, and is equal to the square root of the ratio of inductance to capacitance.

The inductance is established by the diameter of the conductors, and the capacitance depends primarily upon the spacing between conductors (although the type of insulating material also has a major effect). The larger the conductor, the lower its inductance and therefore the smaller will be the line's characteristic impedance. Similarly, the closer together the two conductors are, the greater will be the capacitance, and again the value of the impedance will decrease.

The key point here is not so much the formula which determines impedance, because you can look that up in a handbook whenever you might need it (most of us purchase feedline ready-made, anyway). Rather, it's the fact that the characteristic impedance of a parallel-conductor line depends entirely upon physical factors: the diameters of the conductors, the spacing between conductors, and the type of insulating material.

In the balanced line, any radiation which might occur from one conductor is balanced out by equal and opposite radiation from the other, and so long as conductor spacing is very small (as compared to wavelength) the line has no effective radiation.

However, keeping such a line perfectly balanced is a bit tricky. Anything that might affect one conductor must be made to have exactly the same effect on the other. Because of this, a balanced line should be kept clear of all surrounding objects.

The coaxial line bears the same relationship to the balanced line as the vertical antenna does to the dipole. It's effectively just half of the balanced line.

Coax consists of a single conductor running down the middle of a hollow conducting tube. Both conductors share the same axis, and that's where the name "coaxial" comes from. Most commonly used coax consists of a center conductor surrounded by foam insulation, with a flexible metal shield braid providing the outer conductor, and the whole business enclosed in a weatherproof jacket.

In coax, the center conductor is free to radiate in all directions, but the outer shielding conductor confines all this radiation to the inside of the line. Thus such a line does not depend upon tricky balancing to prevent radiation, and can be run almost anywhere.

Like parallel-conductor line, coax has both inductance and capacitance along its length, and so has a value of characteristic impedance fixed by these L and C values. Again, the impedance of any line is fixed by physical factors: the diameter of conductor (inner conductor), spacing between conductors (ratio of conductor diameters), and insulating material between them. Most common coax has either 52 or 75Ω impedance.

Now that we've met impedance in both the antenna and the feedline, it's time to put the two together.

We've already observed that rf energy flows smoothly only when it encounters no "bumps" or impedance discontinuities in its path. Therefore, if both the antenna feedpoint and the feedline connected to it have exactly the same impedance, the energy cannot tell the difference between them. There will be no "bump" to cause reflection of energy, and everything will flow smoothly. Such a condition is known as a "match" because the impedances match perfectly, and that's the goal of most antenna and feedline adjustments.

Since antenna impedance depends upon so many variable factors, however, while feedline impedance is fixed by a few physical constants, the "matched" condition seldom happens by accident. If the impedance of the antenna feedpoint and the feedline differ, you have a mismatch which reflects energy back toward the transmitter. This mismatch creates a standing wave on the feedline in just the same way that the ends of the antenna create a standing wave on the antenna, and the feedline then can radiate energy – which is normally not a desirable situation, because this radiation may interfere with the desired pattern from the antenna.

In addition, the energy reflected down the line may cause the impedance at the transmitter end of the line to be either too high or too low for proper operation. That's why most hams strive to match their

antennas and feedlines.

Note that while a standing wave is necessary for operation of the antenna, it's not desirable on the feedline. In fact, the strength of the standing waves on the feedline (voltage standing wave ratio, often abbreviated merely swr) is used as a measure of antenna system performance.

What Does SWR Do For You?

We have now seen how a resonant antenna radiates energy by means of the standing wave of voltage and current created upon it, and we have seen that an impedance mismatch between feedline and antenna can cause a similar standing wave to be created upon the feedline.

This standing wave on the feedline is not considered to be desirable, because from an engineering standpoint any one part of a system should do only the job it's there to do, and not do the job of some other part. The purpose of the antenna is to radiate, that of the feedline is to carry the energy – all of the energy – from transmitter to antenna, and if the feedline does some of the antenna's job of radiating, this is not good.

Of course, you might connect the transmitter directly to the antenna with no intervening feedline, and that's exactly what connecting a random-length, nonresonant hunk of wire to a transmitter amounts to. If it's necessary to get a signal out at any cost, this is an acceptable solution, but the directive pattern of such an antenna is unknown, and transmitters sometimes turn out to be difficult to operate with six-inch arcs of rf energy leaping from every sharp corner! It's important to note clearly at this point that the existence of standing waves on the feedline will *not* make it impossible to radiate energy. They may make it impossible to get the energy out of the transmitter, by causing changes in effective feedline impedance, but that can be remedied by adjusting the legnth of the feedline. The primary purpose of getting a good match and resulting freedom from feedline standing waves is to let the antenna operate as it was designed to, and to prevent undesired radiation.

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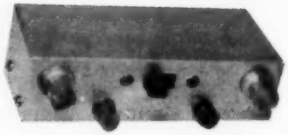

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The most commonly used measure of feedline performance is the swr (or vswr). The term derives from the earliest means of measurement. You'll recall that the standing wave is essentially stationary; that is, on the antenna the voltage is always maximum at the ends and minimum in the middle (for the half-wave centerfed dipole we used as an example). It works the same way on the feedline. The standing wave on the feedline will produce a voltage max imum at some points, and at other points a quarter wavelength away from these maxima, voltage will be minimum. The swr is simply the ratio between the maximum rf voltage and the minimum.

Fig. 11-14. Most certain protection for amateur equipment against danger of damage by lightning involves large DPDT switch connected as shown here, to remove antenna connections from station's equipment and connect antenna instead to ground by heavy, short leads. This effectively converts antenna installation into lightning rod structure. Even this, though, may not protect against a direct hit.

Thus, if there's no standing wave at all, the maximum and minimum will be the same, and the ratio will come out to be 1.0. Therefore an swr of 1 (or 1:1) means that no standing wave exists, and any *smaller* value is simply impossible, by definition.

If the standing wave were using all the energy in the feedline, the ratio would be nearly infinite, as it is on the antenna.

In practice, the swr usually ranges from 1.05 or so up to possibly 10. The higher the swr, the greater the magnitude of the standing wave on the feedline.

We saw earlier that the ratio of voltage to current created an impedance for the antenna, which varies as we move along the conductor. We also saw that the characteristic impedance of a feedline is determined by physical rather than electrical quantities.

The swr on a feedline modifies the *effective* impedance of that line, although its characteristic impedance remains unchanged. An swr of 2 means that the voltage swings through a 2-to-1 range of variation. The minimum will have only half the voltage that is present at a maximum.

Since with power remaining constant, voltage and current must have a constant product, the current goes through the same range of variation. This must, then, mean that effective impedance goes through a 4-to-1 variation. When current in the line is maximum and voltage minimum, impedance is minimum. When current is at its highest value and voltage at its lowest, impedance is maximum.

As it happens, this variation in effective impedance swings around the "characteristic impedance" as a center point. With 75Ω line and an swr of 2, the effective impedance would range from 37.5Ω minimum to 150Ω maximum. (Actually, since it's impedance, there's also a reactive component, but right now we'll ignore it. This is oversimplification, but with a purpose.)

If the swr were to climb to 10, then the impedance swing would be from 7.5Ω to 750Ω.

One of the effects of swr on a feedline, then, in addition to making possible unwanted radiation, is to make the effective impedance at the transmitter end of the line become something other than what you thought it was. This is what makes a line with high swr difficult to work with at times. Transmitters are designed to feed specified feedline impedances; if swr puts the actual effective impedance out of that range, things don't work right.

The multiplying effect upon voltage (maximum-voltage levels) is another problem of swr. It's easy for the voltage at a maximum to be greater than the feedline or the transmitter insulation is designed to handle. Even a 10W transmitter can develop quite respectable voltages when the impedance is high enough. Similarly, the current maximums may cause the feedline conductors to heat up enough to melt the insulation.

So now that we know some of the problems, what can we do about it?

The cause of standing waves on feedlines is, as we saw, the presence of impedance "humps" in the path of the rf energy. With no humps, no standing waves are created. The cure for unwanted standing waves, then, is to remove the humps.

The easiest way to do this in theory is to adjust the antenna impedance until it's a perfect match for the feedline. Then there will be no hump, and no problem. The swr will be 1.0.

However, antenna impedance is subject to many variables, and feedlines come in only a few impedance levels. What if they don't match?

The answer in this case is to introduce a "matching network," which is a fancy name for "anything that will make a smooth match." A tuned circuit makes an excellent matching network; when it's resonant, you can get almost any impedance levels you like by just tapping the coil at the proper number of turns. These are often used, and known as "antenna tuners," but usually a long run of mismatched feedline separates the antenna and the tuner, with a short run of line from transmitter to tuner. The swr is low only over this short line.

Many other types of matching networks are possible. Impedance of a parallel-conductor line depends upon its conductor spacing, in part, so a "tapered" section can be built which changes smoothly from one impedance level to another, and used as a transformer.

It's also possible to use a quarter-wave section of feedline and a transformer to step impedance up or down, and to cascade several such sections if necessary to get the proper ratio.

Any antenna handbook includes quite a bit of material on impedance matching networks, because they are the heart of practical antenna construction.

One point mentioned in FCC study question 43 has not yet been discussed, and it fits into a discussion of matching networks as well as it does anywhere else. That's the subject of protection against lightning.

Obviously, any large metallic structure such as an antenna is a tempting target for lightning, and since the laws of nature have

neither conscience nor memory, it's a fairly good bet that unless equipment is protected, it can be damaged.

The most certain protection is a large knife switch, of the sort you see in old monster movies where the mad scientist shoves home the switch to jolt life into his creation. A hefty switch of this nature, with the arms connected to the antenna, one pair of poles to the equipment, and the other pair directly to ground with a short, heavy braided strap, provides almost certain lightning protection. The energy need not jump the gap to get to the equipment, when it has a direct path to ground.

Such a switch upsets the swr on coax lines, though, and isn't the most attractive item in any station. An alternate but less sure means of protection is to disconnect the antenna cable from the equipment and connect it to a direct ground whenever a thunderstorm threatens, and whenever the station is not in use.

Lightning arrestors are sold which provide a spark gap and are said to help prevent lightning damage. While they work as claimed, they are much less sure protection than is physical disconnection of antenna leads.

. . . Staff■

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The Pink Ticket Rejector

Hams sometimes get into trouble with the FCC because they have made a mistake in tuning a frequency multiplier or PA stage. For example, if the multiplier stage following a 3.5 MHz oscillator is accidentally tuned to 10.5 MHz instead of 7 MHz, the PA can be loaded on 10.5 MHz; and if this is done even a short transmission is likely to produce an unwanted "QSL" from the FCC! Mistakes like this can be prevented by using the simple, easily built absorption wavemeter shown in Fig. 1. Only one coil is required in this meter, the low frequency range being obtained by switching a padding capacitor in parallel with the variable tuning capacitor. With switch S1 open the tuning range is approximately 6.8 to 30 MHz, and with S1 closed it is approximately 3.5 to 6.8 MHz.

Construction of the wavemeter is simple. It can be put together in a metal utility box, on a wooden panel and baseboard, or even in a cracker can of the right size. The coil can be wound on any type of ¾ in. diameter form. If nothing else is handy, a short length of dowel could be used. The coil winding consists of 7 turns of 20-gage

wire, close wound. Both the tuning capacitor (C1) and the padding capacitor (C2) should be 500 pF components, but the values of the other components are not critical.

Any meter having a full-scale deflection between 100 μA and 1 mA can be used. If the wavemeter is built in a metal box, L1 must be mounted outside the box. A slow-motion drive is not needed. If C1 is fitted with a pointer type knob and a cardboard scale is cemented onto the front panel, the calibration points can be written on the scale in ink.

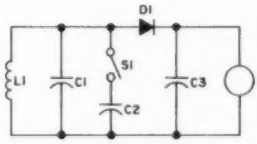

Fig. 1. L1 – 7 turns 20 gage enameled copper wire, close-wound on a ¾ in. form; C1 – 500 pF variable capacitor; C2 – 500 pF fixed capacitor; C3 – Fixed capacitor, any value between 1000 pF and 0.01 μF; D1 – Silicon or germanium; M1 – Moving coil-meter (100 mA–1 mA).

When it came to calibrating the wavemeter I thought of a simple method that I have not seen described before. I soldered about 2 in. of wire onto one end of L1, and about 10 ft of wire onto the other end. I then connected the short lead to the antenna terminal of my receiver and strung the 10 ft of wire up as a temporary antenna. I then tuned the receiver to a steady signal at each frequency at which I wanted a calibration point, and adjusted C1 until the strength of the received signal suddenly dropped sharply, indicating that the wavemeter was tuned to the frequency of the signal. I was then able to mark this frequency on the cardboard tuning scale. The drop in signal strengh was very sharp so calibration was easy. Once enough calibration points had been obtained the temporary wires were unsoldered and the wavemeter was ready for use.

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wavemeter will not tune as high as this, push the top turn of coil L1 about 1/8 in. away from the other turns. This should reduce the inductance sufficiently; a spot of cement will hold the turn in its new position.

To use the wavemeter for checking a transmitter, bring coil L1 close to the tank coil of the stage being checked, apply power to the stage and rotate C1 until a maximum reading is obtained on the meter. The output frequency of the stage can then be read off from the wavemeter tuning scale.

The wavemeter can also be used as a radiation meter for tuning up single-wire antennas. If it is tuned to the transmitter output frequency and placed near to the antenna wire, maximum reading on meter M1 will indicate maximum output power from the transmitter.

Many readers will have realized that the calibration method I suggest uses the principle of the rejector circuit. That is why I have called the little gadget "the pink ticket rejector"!

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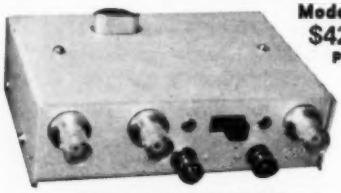

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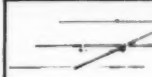

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As well as being a ham operator, I had been a general shortwave monitor for over fourteen years and I was particularly interested in UFO reports. The young couple's statement concerning strange sounding impulses on their car radio just before being abducted by the UFO was of special interest to me since I had been picking up strange impulses on my VHF monitor at home for the past two weeks. One night they appeared suddenly; weakly at first but gradually stronger, and only at night. I decided to experiment with a directional VHF antenna but my attempts to locate the signal were fruitless. It seemed to be of

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equal intensity in all directions. Little did I suspect the signals to be coming from almost directly overhead, thousands of miles into space. I had never participated in moonbounce experiments but considered this as a possible source; but for what purpose?

Suddenly my train of thought was interrupted as an unusual amount of electrical interference started playing havoc with the car radio – unusual because I was on a desolate country road nowhere near any high-tension lines or buildings. Just an occasional farmhouse off the road in a field.

My curiosity aroused, I turned on my rig. All bands were dead except for pulsating zings remotely resembling the sound made by an Air Force radar station.

I was getting tired of playing guessing games and was becoming perturbed with the puzzling interference. Probably some clown with a linear amplifier on a wireless FM broadcaster, I thought. But then I noticed a faint halo of light on the road surrounding my car. This in itself might not have been unusual on a clear night like this except for the fact there was no moon out. The halo was keeping pace with my car at 60 mph. I speeded up, then slowed down; it stayed right with me. Suddenly a cold chill came over me. I knew it wasn't my imagination and I became aware of a strange noise above me like a jet airliner with engines at idle speed except it had a three-tone musical note.

I was too frightened to stop the car and I wanted to look out the window above me but the fear of what might be there kept my hands glued to the wheel, my back to the seat, and my eyes to the road for I was at least ten miles from civilization. I had never felt so alone before and I was beginning to wonder if maybe I really wasn't there at all but at home in my bed dreaming. I wanted desperately to believe that, but I knew this was for real as I started to recall the experiences of the young couple on the radio interview. I tried to console myself by remembering the fact that they were not harmed.

Just then a strange voice came from my ham radio. It was a hollow, metallic voice

such as you would imagine from a computer. If they were alien visitors, they must be trying to communicate, I thought. Through shortwave listening I had heard many languages from many countries but nothing had ever sounded like this. It was almost like a tape recording being played backwards. In desperation, I grabbed my microphone and shouted, "Who are you? What do you want? Where do you come from?" The only reply was more of the same mechanical "garble."

All I could think now was panicky half-thoughts. I was terrified at the thought of never reaching home again. Up ahead I saw the lights of a town. I slammed the accelerator to the floor and raced toward the approaching lights.

When I was about three miles from the town, the spacecraft veered off to my left enough so that I caught a terrifying glimpse of it. It was saucer shaped, about fifty feet in diameter with flaming red, blue, and green lights on its perimeter. It appeared to have a number of portholes encircling its dome and the bottom half was spinning at a fantastic rate of speed. The face I saw in the starboard porthole I could never describe because no one would believe me. I only knew that it was definitely alien.

As suddenly as it had appeared, the craft took a 90-degree left turn and hurled away upward toward the stars. The chill that engulfed me eased off and I slowed the car to a safe speed again. As the craft disappeared back into the heavens, the radio impulses faded away and my ham radio came to life again, teeming with activity on every band. With this, I nervously keyed my microphone, identified my mobile station and asked if any other hams in the area had seen anything unusual in the sky that evening. Several other locals answered my call and jokingly asked me to stop by for black coffee. It sounded to them as if I needed it.

This was the only QSO I never logged for I knew that I was the first and only earthbound radio amateur to have worked DX from beyond the stars, but who would believe me? Do you?

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1	2	3	4	5	(6)	[7]
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EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
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PHILIPPINES	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	14A	14	7A	7	7	7	7	14	14	14	14	14A
SOUTH AFRICA	7	7	7	7	7B	7B	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	7	14	14	14	14	14

WESTERN UNITED STATES TO:

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ARGENTINA	14	14	14	14	7A	7	7	14	14	14A	21	21
AUSTRALIA	21	21	21	14	14	14	14	7	7	7	14	21
CANAL ZONE	21	14	14	7A	7	7	7	14	14	14	21	21
ENGLAND	7	7	7	7	7	7	7	7	7A	14	14	14
HAWAII	21	21	21	14	14	14	7A	7	14	14	14	21
INDIA	14	14	14	7A	7B	7B	7B	7B	14	14	14	14
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MEXICO	14	14	14	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	7A	7B	7B	7B	14	14	14	14
PUERTO RICO	14A	14	14	7	7	7	7	14	14	14	14	14A
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U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	14
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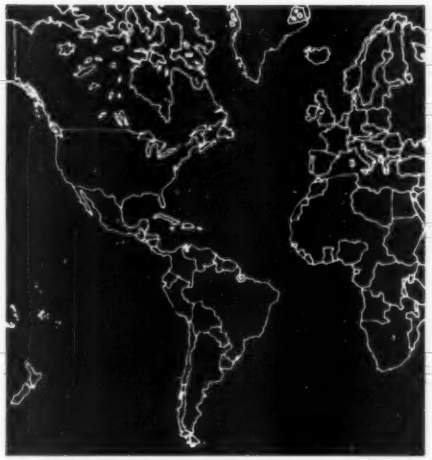

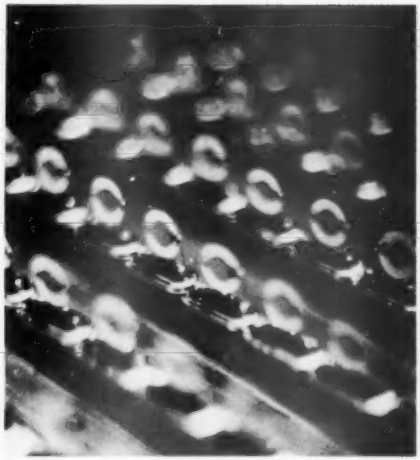

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